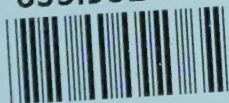


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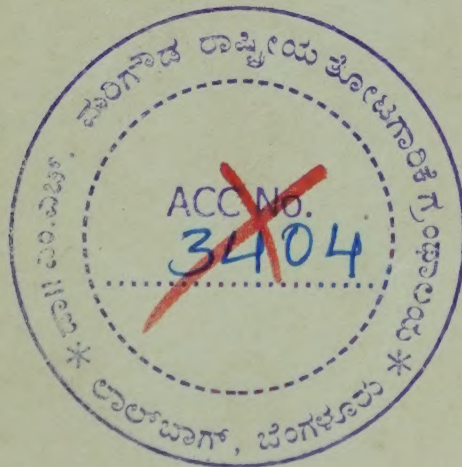
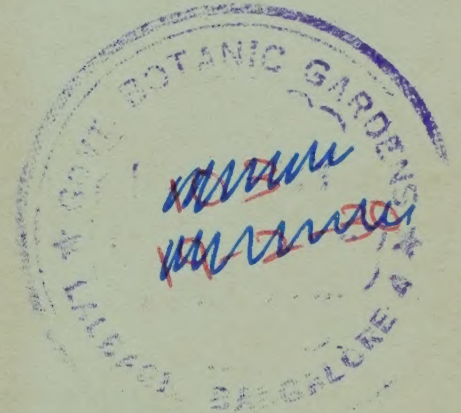
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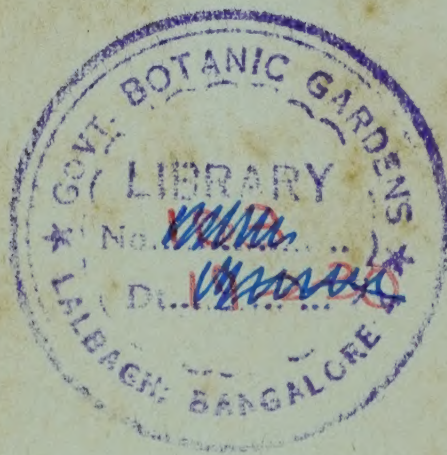
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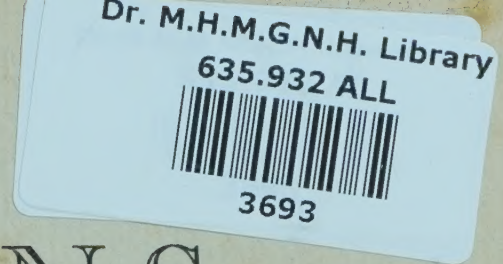
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CARNATIONS





"The fairest flowers o' the season are our carnations." . . .
Shakespeare.



CARNATIONS

FOR EVERY GARDEN
AND GREENHOUSE

By MONTAGU C. ALLWOOD, F.L.S.

With a FOREWORD by

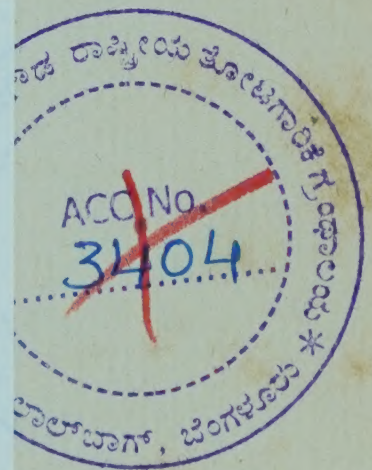
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(President of the Royal Horticultural Society)



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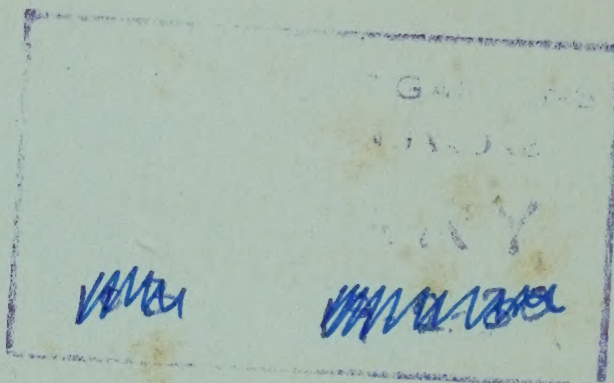
COUNTRY LIFE

20 TAVISTOCK ST., COVENT GARDEN
NEW YORK : CHARLES SCRIBNER'S SONS

ACC NO 3693

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PRINTED IN GREAT BRITAIN

First published in 1926

DEDICATION

NOT alone to ardent admirers, but to all lovers of a garden, who could, if they would, grow the Divine Flower, this tribute from a lifelong devotee to the most beautiful of all flowers is respectfully dedicated.

FOREWORD

MR. MONTAGU ALLWOOD claims to have a great knowledge of carnation growing, and very fairly so, as in 1895 he began crocking pots for them. Perhaps in another way I may also claim to have some knowledge of the craft. My earliest acquaintance with the carnation dated from 1856, when my dear mother, Mrs. Mark Wood, received a cutting of the Blush Malmaison from Lady Middleton of Birdsall, her great friend. I remember we grew it in an unheated house close by the door up against the wall for many years, covering it up with newspaper during the winter. Mercifully my friend, Mr. Allwood, did not begin so early as this; if he had, what a ponderous book he would have written, and how many more new carnations would he have invented!

I am pleased to see, from the author's own words, that the carnation has helped him to enjoy life with peace and happiness, and no doubt he allows his new races of plants, *Dianthus Allwoodii* and Perpetual Border Carnations, to share in this credit.

I am sure all lovers of the carnation, and they are numerous, will benefit by this book, for we are none of us infallible, not even the youngest.

LAMBOURNE

(*President, Royal Horticultural Society*).

PREFACE

THIS book I believe to be the best way of recording my life's work with *Dianthus* and its hybrids.

When as a boy I entered horticulture in 1895, the carnation had fallen upon evil days. The Border Carnation was a pampered pet, grown almost exclusively for exhibition at flower shows, and not for garden decoration. The homely little pink was despised by some, and rejected by others; its only home seemed to be the rural retreat. Whilst the Perpetual-flowering Carnation was being developed more in France and America than in this country, the *Souvenir de la Malmaison* was the flower of fashion and, perhaps, justly so.

Happily to-day the carnation holds a proud position; it is regaining its popularity in the garden, whilst the pink and its hybrids boldly hold up their heads in almost every garden and public park, for it is the flower of the million. The Perpetual-flowering Carnation is one of the most popular of all cut flowers. All this development has been brought about by a better general knowledge of the plant's requirements, new and improved colours in all races of carnations, the enriching of their perfume, but, perhaps, more than all this, by the fact that it is one of the cheapest of plants to cultivate, whether in the garden or greenhouse.

If in the past the writer and other growers have helped to develop the carnation by raising new and improved varieties and races, then in turn the carnation has helped me, at any rate, to enjoy life with the peace and happiness that close contact with nature always brings. I am convinced that the development of the *Dianthus* is only just beginning, for I hope to see, some day, carnations almost forming bushes in the garden, others only growing 2 inches high, with great colour variety for rock gardens; perhaps even climbing

and trailing carnations, or Malmaisons with even larger flowers; but, above all, we must retain the delightful perfume and wonderful colourings, or no real progress will have been made.

During my horticultural experience there is no rôle from crock-boy to carnation specialist that I have not filled, so the reader must expect to discover in this book practical knowledge rather than literary skill, and he must remember that it covers all types of carnations, and is written for all grades of horticulturists.

I should like to acknowledge my indebtedness to my colleagues, Mr. George W. Allwood and Mr. Richard Brant, and to Mr. Euan Cox, the editor of the *Garden*, from each of whom I have received valuable help and advice.

MONTAGU C. ALLWOOD, F.L.S.

WIVELSFIELD,
HAYWARDS HEATH.

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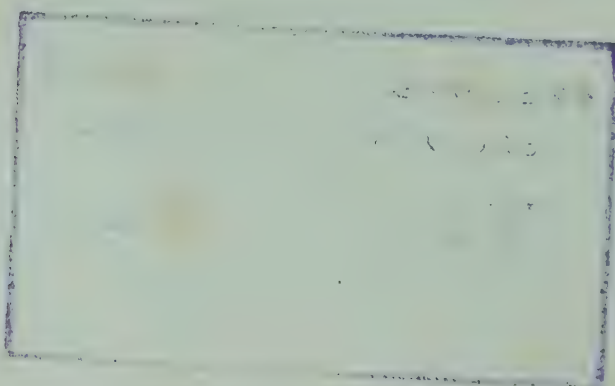
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CARNATIONS

CHAPTER I

THE CARNATION

THE ORIGIN OF THE CARNATION

DIANTHUSES are plants belonging almost exclusively to the Old World. All carnations and pinks of the present day in their various classes, from the gigantic flowering Souvenir de la Malmaison down to the humble little *Dianthus glacialis*, are connected.

Dianthus caryophyllus, the original carnation, has been known in history for several centuries before the Christian Era, and was described by Theophrastus as early as 300 B.C. The genus was given the name Dianthus, from the Greek *Dios*, divine, and *anthos*, a flower. It was a five-petalled single flower about one inch in diameter, and of a pinkish-mauve colour. It was distributed in its wild state over the whole of the southern half of the European temperate zone, but was known more particularly to historians as inhabiting France and northern Italy. It was found in abundance in Normandy, from whence it is supposed to have been introduced into England about the time of the Norman Conquest. Even so recently as 1874 it was found growing in a wild state on the castle walls of Falaise, where William the Conqueror was born. The variations in the flower are the result of continuous cultivation under artificial and highly favourable circumstances, producing, in the first place, well-marked varieties, which were perpetuated by cuttings; from them by means of cross-breeding distinct races have been evolved, gradually showing a wider range of colour and habit.

BORDER CARNATIONS

During the sixteenth century it formed one of the principal flowers of English gardens, and it is from the stock, with occasional assistance of importations from the Continent, more especially in the case of yellow forms, that the British Border Carnation section has sprung.

We are informed by John Gerard in his "Herbal," published in 1597, that yellow carnations were imported from Poland. Parkinson in his "Paradisus," published in the early years of the seventeenth century, gives the impression that the yellow carnation with certain markings had become most popular towards the end of the sixteenth century. Three hundred and sixty varieties are named in Rea's "Floral," published in 1676; probably yellow picotees were amongst them, for they seem to have been freely imported from Holland, Flanders, and the Netherlands. At this time very few were raised in England, for Rea says "multitudes" of them were brought over to London and sold at mean rates to gardeners, who sold them again. The British horticulturist had Dutch competition in those days, but now the Dutchman buys his carnations from England.

The vendors of "Jacks" were evidently in evidence, for poor old Rea says, "Most of these mercenary fellows about London are very deceitful, and whoever trusts them is sure to be deceived, as I myself have often been."

It is interesting to note that in a letter written by Lady Mary Wortley Montagu from Constantinople on January 14, 1716, she described her chamber as being set out with carnations.

It is very evident that the Dutch growers were still sending yellow carnations and picotees to England in the early part of the nineteenth century, for Thomas Hogg, the ex-schoolmaster and eminent florist of Paddington Green, Middlesex, in his book published over a century ago, described them as being difficult to grow, also described them as the "Queene of Beautie and of flowers." The carnation held first place in most of his books.

We know that Queen Charlotte and her daughters had a very complete collection of yellow picotees at Frogmore, which were obtained principally from Germany.

Gardeners were very artful in those days; there was one, Kit Nunn, a barber of Enfield, who excelled in the ability to dress artificially or change the appearance of carnations, and those who did not so artificially treat their exhibition flowers were distressed to return home without either silver cup, silver spoons, punch ladle, copper kettle, or set of china.

Hogg gives an interesting account of a "Flower Christening," a humorous tale of Sam Greenhorn's visit to a London tavern, where a meeting was held to contend for a silver cup and to celebrate the annual feast. The owners of the carnations met with their flowers in an upper chamber of the inn, and their gardeners or helpers downstairs. There Sam finally gravitated, where, at his

expense for wine to drink to their prosperity, the flowers were supplied with names appropriate to their supposed qualities; much of it is fictitious, no doubt, but enough contains a germ of truth to illuminate for later generations the doings of select gatherings of florists a century ago.

We know that the Old Clove Carnation round which so much imagination and sentiment is wrapped, originally came from Holland, also that the original stock was lost many years ago, and another substituted for it.

Perhaps the last importation of important stocks of Border Carnations from the Continent was the German variety, "Germania," brought over by those famous carnation growers, the late James Douglas and Martin R. Smith, who made a tour of the Continent to try to find any new improved forms, and this variety has had considerable influence on many of our present-day yellow grounds and picotees.

No brief survey of the early history and progress of the Border Carnation is complete without mention of the name Dodwell, who was perhaps the greatest Carnationist who has ever lived, and those of us who to-day labour in the fair field of the divine flower owe much to him.

THE PERPETUAL CARNATION

The Perpetual Carnation is the product of several centuries of hybridization and culture, from *Dianthus chinensis*, the Indian or China Pink. It is an open pollinated species: the seed-bearing plant can be chosen from amongst hybrids as well as by inbreeding upon the same plant or upon plants of the same variety. A variety once produced from seed is easily reproduced for a certain period by propagation by cuttings. Improvements in varieties may be made by bud selection, and sometimes by bud variation (sports), as well as from seed variation and by hybridization. Comparatively few improvements are produced by raising new varieties by cross-fertilization. The average at the present time is one in ten thousand, but this percentage will be greatly increased as the standard becomes improved.

We have to thank France for the introduction of the first Perpetual Carnation, which is a distinct race from, and must not be confounded with, the Border, or Malmaison Carnation. Both these sections must have their annual period of rest, but the Perpetual Carnation is perpetual growing and perpetual flowering if slightly protected in winter.

Who first raised this new section is not, up to the present, known. Until quite recently it was generally believed that a Frenchman, M. Dalmais, of Lyons, raised the first winter-flowering carnation about 1844 by artificially crossing De Mahon with the variety Biohon, the offspring being crossed with a Flemish carnation, and the process continued until the type was fixed. But recently M. Chaband found that Remontant, or, as we know them, Perpetual-flowering Carnations, were cultivated at Ollioules, France, before 1750, under the name of Carnation Mayonnais, known also as De Mahon. It flowered from September until June, and possessed all the characteristics of, and still is, a real Remontant Carnation. Seedlings from Mahomas of dwarfer growth and more easy to cultivate have been obtained, but none more floriferous than the type.

If M. Dalmais did not actually raise the first plants of the present type, he undoubtedly greatly advanced their development by interbreeding. M. Schmidt, of Lyons, likewise carried on this work. But the greatest of the early workers on our modern flower was Alphonse Alegatière, also of Lyons, who made marvellous progress: and those of us who can remember some of his later varieties, such as l'Alegatière, can appreciate the good work of this master of his craft. The American *Florists' Exchange* says: "We are convinced that all true Remontant Carnations are descendants of Carnation Mahomas."

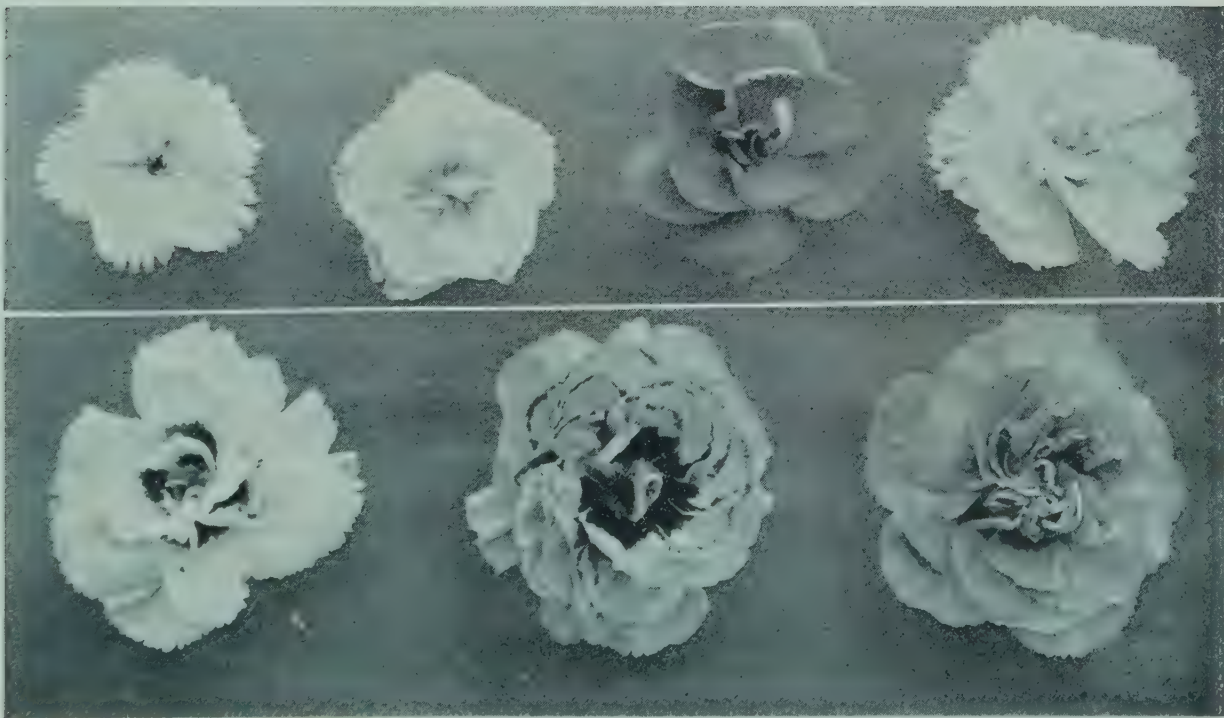
THE AMERICAN CARNATION

We can safely say that the American Carnation originated from exactly the same source as the British, or any other of the European Perpetual-Flowering Carnations from France. The first of this strain was imported into America in 1852 by a French florist, Charles Marc, who lived near New York. He cultivated a number of varieties, which he called Remontant Carnations. These he tried to keep a secret, and would not disclose their French origin. However, in 1856, Messrs. Dailedouze, Zeller, and Garde, of Flatbush, Long Island, secured from a private gardener of Lyons, France, some carnation seed of the same type, also some plants of named varieties, of which La Purité was the most important. In 1858 they commenced to raise their own seedlings. About the year 1869 this firm issued a catalogue which contained the names and descriptions of no fewer than fifty-four varieties of Perpetual-flowering Carnations of their own raising, while at this period another Frenchman, called Donati, of Astoria, Long Island, introduced a variety called Victor Emmanuel, which caused a small



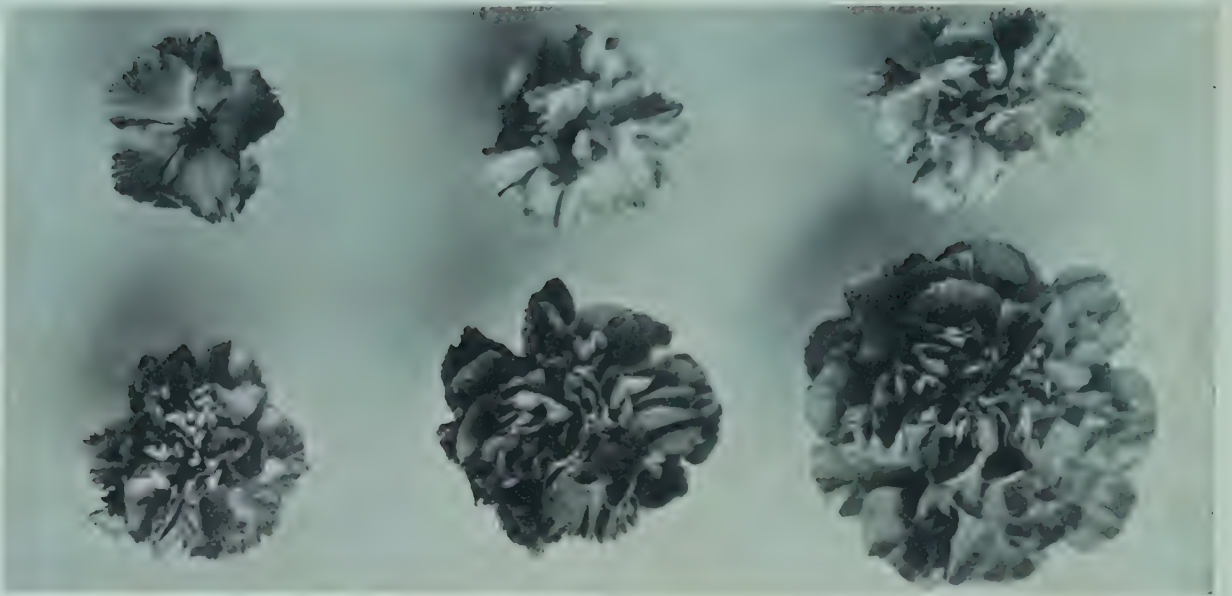
The parents of the modern Carnation.
Left: *Dianthus Caryophyllus*. Right:
Dianthus chinensis. Note variation
in the fringing of the petals.

1



The evolution of *Dianthus Allwoodii*
from the original species to the modern
flower. This has been accomplished
by fifteen years of scientific breeding.

2



The evolution of the Carnation.

3



Various types of Dianthus.

4

sensation in the American horticultural world. It was of the yellow-ground class in colour, and no doubt was the ancestor of many of the present-day yellow-ground Perpetuals.

Mr. Rudolph Heintz and Mr. Joseph Tailby, in turn, took up the raising of new varieties, and Mr. John Thorpe, of Queens, New York, continued the work, and sent out some wonderful varieties between the years 1883 and 1890, of which Portia was the first. How well I remember being shown this famous variety, which, according to our present standard, was a very poor and thin flower; but to prove what imagination and confidence he had in his work, Mr. Thorpe set the standard at a flower 4 inches across on a 2-foot stem as thick as a lead pencil. He thus aimed at a high ideal. His other noteworthy varieties were Mr. B. K. Bliss, Charles Henderson, E. G. Hill, and James Y. Murkland, which he described as the most perfect carnation he had ever seen, and which he stated was the beginning of the non-bursting race.

Mr. W. P. Simmons sent out Daybreak, Tidal Wave, and Silver Spray, which were obtained from seed presented by Mr. Thorpe when Mr. Simmons left his employment.

After this start had been made many other American florists began to realize the great future of the carnation, and innumerable varieties were introduced, of various colours, shades, and qualities.

Mr. F. Dorner, of Lafayette, raised William Scott, Lady Bountiful, White Perfection, Scarlet Glow, and White Wonder.

In 1890 Mr. C. W. Ward raised G. H. Crane, a very productive scarlet variety. He also raised Governor Roosevelt, Harry Fenn, Mrs. Theo. Roosevelt, and Mrs. C. W. Ward.

Mr. E. G. Hill, of Richmond, Indiana, became interested in carnation raising, and distributed many dozens of new varieties, but not any of note until 1897, when he sent out the famous white variety, Flora Hill, a most excellent white, and, in 1899, another variety called America, coral-red in colour.

It was Mr. Peter Fisher, of Ellis (Mass.), who astonished the whole carnation world by raising the famous variety Mrs. Thomas W. Lawson, in 1895, the result of a cross between Daybreak and Van Leeuwen. He sold the stock to the late Mr. Thomas W. Lawson, the great copper magnate, for thirty thousand dollars, and it has proved to have been worth every cent of that large sum. The same raiser sent out Enchantress, Governor Wollcott, Nelson Fisher, and Beacon.

ORIGIN OF BRITISH TREE OR PERPETUAL-FLOWERING
CARNATIONS

There is not the slightest doubt but that the British Tree Carnation, the name under which our modern flower was first known, was originally imported from France about 1856, but not until M. Alegatière raised some seedlings which possessed a more compact habit, and were much more floriferous than those raised by Dalmais, did this section become at all popular in this country. The variety l'Alegatière was grown extensively about 1865 for cut blooms for Covent Garden Market, and old carnation growers have told the writer that these were grown trained upon the roofs of greenhouses, not being allowed to bloom for the first two years. Other early French varieties were kept from flowering during the first year and wintered in cold frames, so that they made quite large bushes for flowering during the second winter.

If we look at the early British varieties of Perpetual-flowering Carnation, beyond a few varieties, no one can claim to have worked great wonders, perhaps because in this country the horticulturist had close at hand so many beautiful Border varieties which have tempted him to use their pollen in performing the cross, this, of course, being a fatal act, stepping back a hundred years.

Old British varieties like Bronwell Lewis, Lord Rosebery, Queen of Pinks, Dr. W. G. Grace, were little removed from Border varieties. On the other hand, Winter Cheer, an old variety of sterling merit, has played a prominent part in producing William Robinson, Yule Tide, Winter Scarlet, and Britannia. Miss Joliffe will always live in our memory, so indeed will Uriah Pike, but the latter was not a Perpetual-flowering Carnation in the true sense of the phrase. Pride of the Market and Duchess of Portland were the worthy children of a noble race.

It proves on what narrow lines the early English raisers were working that when Mrs. T. W. Lawson was first shown in England it was rejected by the R.H.S. on account of its unkempt flower. This is difficult to understand now that the full worth of this race is becoming realized; yet from the first British horticulturists endeavoured to raise a Perpetual-flowering Carnation with smooth-edged petals and of a more refined appearance than the type from over the Atlantic. In doing this they sacrificed too much in the way of productions, perfume, and length of stem. However, in Britain the future is bright, and perhaps here is the best opportunity to give credit to those two pioneer growers, Mr. Clark of

Leighton Buzzard and Mr. Dutton of Iver, Bucks, both of whom saw at an early age the possibilities of the Perpetual Carnation; Mr. H. T. Mason and Mr. W. H. Page of Hampton also deserve mention. Fortunately to-day British carnations are recognized as the best in the world.

Some of the early British varieties were used by the American carnation specialists. For instance, Miss Joliffe itself was admittedly a failure in the States, yet that most successful early American raiser, Mr. Thorpe, raised Daybreak from it—one of the finest carnations ever raised, and one from which all our best present-day varieties are of direct descent—using Miss Joliffe as a pollen parent; and it is very questionable whether Tidal Wave, sent out in 1888, and Silver Spray, obtained by the same raiser, were not from the same blood. Mr. Charles Willis Ward admits in his splendid book, "The American Carnation, and How to Grow It," that he obtained General Macio, General Gomez, and Governor Roosevelt by hybridizing American sorts with the pollen of the English variety Winter Cheer. So the fact is evident that some of the early British varieties of the Perpetual Carnation helped to develop the flower even in the varieties which we receive from America.

Mr. H. Burnett, the skilled carnation raiser of Guernsey, obtained during 1903 the variety Mrs. H. Burnett, which was so popular, by crossing Mrs. T. W. Lawson, the American variety, with Pride of the Market, an old British variety of a similar shade to its progeny; and Mr. A. Smith, of Enfield Highway, obtained in 1904 that epoch-making carnation Britannia by a cross between Mrs. T. W. Lawson and Winter Cheer. The writer obtained the variety Lady Alington by intercrossing seedlings from Britannia on to White Perfection, which itself is a direct descendant of Tidal Wave. The variety Baroness M. de Brien I obtained when carnation specialist to Messrs. Stuart Low and Co. by crossing Mrs. T. W. Lawson with Mrs. H. Burnett. Mr. Lancashire's Rose Doré, Mr. C. Engleman's Carola, and Mr. Lawrenson's Snowstorm, were pioneer British varieties which have played their part.

SOME OLDER PERPETUAL CARNATIONS

It is never wise to allow one's memories to go too far back into the past, but I remember La Purité and Mlle. Carlé when France held sway in the carnation world. Such varieties as l'Alegatière closely followed; in fact, it grew so tall that it could have been described as the first climbing carnation. James Veitch and Sons,

who led British horticulture from Chelsea, sent out the really great carnation Winter Cheer and Mad. Thérèse Franco, while blushing Miss Joliffe came from the north. How well I remember seeing its first flowers. We held our breath over its purity and classic refinement, but even the most daring catalogue fabricator could not call them free flowering.

Then we received from America, with much self-esteem and some disappointment, Red Portia, Edwardii, and dark General Macio, followed by those really great carnations Grace Wilder and Estelle; but perhaps even these varieties were grown more for love than profit. However, such cannot be said of Tidal Wave, which turned the tide. Then America sent us Lizzie McGowan, a free, glistening white; Daybreak, a free, pale pink; William Scott, deep pink; and America, a brick-red of grand form and good growth; and the Winter Flowering Carnation passed from being a plant of hopes to one of reality.

On the other hand, the new British varieties of that day, like William Robinson, Buttercup, and Countess of Warwick, only flowered during the spring.

But all these beauties of their day soon disappeared owing to the advent of the Bread-and-Butter Carnation, with stems like wire, calyces like gutta-percha, and petals like leather. Mrs. W. Lawson was the first to appear. Then came the spotless Glacier, the chaste Lady Bountiful, G. H. Crane, Governor Roosevelt, Harry Fenn, and a host of others too numerous to mention. How well I remember when the Chicago Carnation Company distributed that magnificent carnation Fiancé. They issued a startling booklet with a blood-red cover; they advertised Fiancé and wrote it up to such an extent that life itself seemed all too long. Money was cabled, everything was done to capture this elusive maid, yet plants of Fiancé did not arrive. Then they withdrew the variety for a year, as they could not cope with the demand. Another year went by, and when Fiancé did arrive, no carnation has ever so completely failed; it had all the vices and none of the virtues of its race.

MALMAISONS AND PERPETUAL MALMAISONS

The original Souvenir de la Malmaison was a seed sport from the Remontant Carnation. It is a generally accepted fact that the first original plant of this type bore flowers which closely resembled the Souvenir de la Malmaison Rose. A Frenchman named M. Laisie is supposed to have raised the first Malmaison from seed in 1857,

this being the old Blush Souvenir de la Malmaison. In 1876 it threw off three sports in this country, which were named Lady Middleton, Souvenir de la Malmaison Crimson, and the famous Souvenir de la Malmaison Princess of Wales, named after the late Queen Alexandra, when Princess of Wales, which became the flower of fashion during the latter part of the Victorian era.

Since then we have had many new varieties raised on the Continent and in this country, the late Martin R. Smith being the most successful raiser; yet few, if any, of his varieties have survived.

In 1906 Mr. H. Burnett, of Guernsey, obtained the first Perpetual-flowering Malmaison from the same pod of seed that produced the carnation Mrs. H. Burnett, and this was simply a repetition of what took place in 1857, except that the strain had been developed and made more Perpetual. Since that time we have all added to the collection of Perpetual Malmaison varieties, which have practically supplanted the older type, and these can be found in the catalogue of any progressive carnation specialist.

PERPETUAL BORDER CARNATIONS

This is a race of hybrids obtained in the first place by crossing Border Carnations (*Dianthus caryophyllus*) with Perpetual-flowering Carnations, which, as we have seen, are mainly developments of *Dianthus chinensis*; in this, as with all our hybridizing work, seedlings and not named varieties were used in their development.

The first Perpetual Border Carnation was introduced in 1913 and received a mixed reception. Some claimed to have raised this new race of carnation previously, and some horticultural papers tried to belittle them, while one powerful Carnation Society threatened to ignore them, but in spite of this opposition to-day the Perpetual Border Carnation is admired and recognized, simply because it is impossible to hide or blot out a new race of good plants.

This new section of the carnation was created, in the first place, by interblending the old British Border Carnation with the modern varieties of Perpetual-flowering Carnations, a process which was only achieved after much labour, patience, disappointment, and expense. This will be more readily appreciated when it is understood that the Border Carnation is quite distinct from the Perpetual-flowering Carnation. The latter is to a large extent, if not entirely, a development from the Indian Pink (*Dianthus chinensis*), so that it will be seen that the intermixing of these two separate races of *Dianthus* with

their distinct habits of growth and other characteristics was not an easy task to begin with.

The object was to retain not only the perfectly formed flower colourings and compact low-growing habit of the Border Carnation, but to instil the perpetual growth and freedom of flower of the Perpetual-flowering Carnation, and yet have a hardy, robust-growing plant for outdoor cultivation—in fact, a very similar development to that of the Hybrid Tea Rose.

DIANTHUS (ALLWOODII)

This race of hardy garden plants (*Dianthus Allwoodii*) was named after my firm by the Scientific Committee of the Royal Horticultural Society. It took nine years of work in crossing the Perpetual-flowering Carnation on to the old-fashioned hardy, old, fringed White Pink (*D. plumarius*). The disappointments met with are too long a story to enter into here, except that it will be readily realized how that the magenta shade of pink which predominates in the original species of *Dianthus* was exceedingly difficult to overcome. In addition, the greater percentage of seedlings for a number of years were various poor forms of pinks.

It is interesting to note that one morning I noticed that one of our most promising seedlings was looking ill, so I propagated a few cuttings from it, which fortunately rooted, although the parent plant died. This seedling was eventually named Mary, and became the parent of all our best varieties, such as Susan, Arthur, and Eleanor.

For many years I have realized that with the great development and competition of other flowers, the pink, in its old form, could never hold a prominent position as a garden plant, and so I set to work to create a plant which was perpetual flowering during the entire spring, summer, and autumn, which was exceedingly hardy, robust, and easy to cultivate, and yet, at the same time, had the perfect perfume and lovable flowers of the pink; in short, a plant that really was a Perpetual Pink in actual being, and not simply in name.

I also strove to develop a plant which would find a place in every garden and required no skill in cultivation. I felt practically certain that such a development from *D. plumarius* was possible. As yet I may not have reached my ideal, but progress has been made.

Other strains of pinks are Herbert's Pinks, which have been raised by that great gardener, Mr. Herbert, of Birmingham, from the old types of Laced Pinks, and have exquisite form and colouring.

Ladham's Pinks, that for many years Mr. Ladham, of Southampton, has been developing, and Prickard's Pinks are a hybrid race in which *D. Atkinsonii* has been used, and form a charming group.

PINKS

The predominating parent of the pink is *D. plumarius*. Loudon, as well as some other early authorities, considered the pink not solely an improved cultural form of *D. plumarius*, as is, perhaps, too rashly assumed in these days, but that *D. deltoides* and varieties of the carnation at one time or other contributed to its production. A careful examination of the case leaves one satisfied that Loudon's conception is largely consistent with fact.

Gerard is the earliest authority to introduce us to double pinks, obviously forms of *D. plumarius*, of which there were two or three when Parkinson wrote. If we are to credit Rea, pinks were held in little esteem, and were grown in gardens mostly as edgings to flower-beds; they were sometimes used in posies along with damask roses. Writers on gardening in the early part of the eighteenth century include pinks among other flowers esteemed in gardens. It is at this period that the Pheasant-Eyed Pink first appears.

The muslin weavers of Paisley, in Renfrewshire, as a class, were greatly devoted to floriculture, and one or more of their number, about 1785, secured seeds of pinks from London, from which were produced some Laced Pinks. The culture of this flower was entered on with such enthusiasm, and attended with so great success, that varieties were shortly distributed over the country. These were known as Scotch Pinks, and though that name has somehow become attached to "black and white" varieties, or those without a lacing, it is clear that the weavers themselves considered their laced productions the more meritorious. During the first half of the last century the cultivation of pinks had undoubtedly reached its greatest perfection, and since then they have gradually declined in favour, and it is doubtful if the delightful black and white section, also called Plain Pinks, is now even in existence.

Laced Pinks were divided into two sections, called according to the depth of colour in the markings dark-laced and fine-laced. The markings were on a white ground. There was also another section called Rose Pinks, in which the ground colour was rose, with the petals marked and laced with a darker shade. Anne Boleyn is of the last-named section, a variety raised about seventy years ago, and figured in the *Florists' Magazine*, 1835-36. It is still cultivated alike for its beauty as a flower and for its pleasant perfume.

CHAPTER II

PROPAGATION

THE deterioration of varieties of carnations in amateurs' establishments is obvious to all intelligent cultivators. This is due to many causes, but careless propagating is the chief one; it is useless to propagate exhausted worn-out stock.

A poor cutting may be taken from a good plant, or, on the other hand, an apparently good cutting may be taken from a plant weak in constitution or sickly or overfed. The cutting itself may be weakened by too high a temperature in the propagating house; or by having to sustain itself too long without roots by reason of a varying temperature while rooting; or by remaining too long in the sand after rootlets have appeared before being potted; or by attacks of diseases; or by improper growing. There are a hundred and one reasons which would give bad results.

In selecting the cuttings which are to make the plants for next year's stock, try not only to perpetuate the good qualities of the variety, but aim at improving them. The mere taking of a lot of cuttings promiscuously from the plants and inducing a large quantity to root does not constitute skilful propagation. There is no doubt that the cutting reproduces in all details the plant from which it was taken.

I believe in selecting, as far as possible, a uniform average size in cuttings, avoiding the abnormally large as well as the small cuttings, because from an even, uniform set of cuttings uniformity of plants results. It is unwise to attempt to root small, soft cuttings which have no energy stored up within them, because a week or ten days longer on the parent plant will make first-class cuttings of them.

I dwell upon this matter of careful selection of cuttings because I realize the importance of it. I feel I cannot write too strongly, nor emphasize too emphatically, the vital importance of selecting only the very best and strongest cuttings. The difference in the bloom produced from good and bad cuttings of the same variety is as distant as the Poles. Because the price is low, it does not naturally



From left to right: Border Carnation; habit of growth. Perpetual-flowering Carnation; habit of growth. Perpetual Border Carnation; habit of growth.

5



From left to right: Ordinary Garden Pink; habit of growth. *Dianthus Allwoodii*; habit of growth. Perpetual-flowering Carnation; habit of growth.



A flowering growth: the three centre growths correct cuttings, the top and bottom incorrect cuttings.

7



Flower growth with bloom cut causing it to produce cuttings. The top three cuttings are correct, the bottom two are dormant growths unfit to use as cuttings.

9



Left: Correct heel cutting ready for inserting into sand. Right: Correct piping cutting trimmed ready for insertion.

8



Left: Inferior heel cuttings removed from too high up on a flowering growth. Right: Long-jointed weak cutting. Both of the above will never grow into strong plants.

10

follow that the goods are cheap, nor because the price is high does it follow that they are good, yet, as a rule, the two go together.

When selecting your cuttings there is every reason why you should select them well and carefully—not only the best cuttings, but from the best plants. Some plants are sure to be superior to others, producing the best-formed flowers of the best colour, which are thoroughly healthy and of vigorous growth. It is folly to think that you can propagate weak cuttings, and cure your plants of any defects afterwards. A permanent cure of any defect in a plant's make-up is most difficult.

Over-propagation of seedlings previous to their being sent out, or afterwards, has ruined the constitution of far too many promising novelties in the past.

STOCK PLANTS

The stock or parent plants should be grown carefully, in a good light, and under normal conditions, and should be plants that have not been fed to excess. In feeding avoid fertilizers with any forcing element, but use a cool, slow-acting carnation food, one that is more a food than a stimulant, and which will build up the plant. Cuttings from such plants would be strengthened rather than weakened.

Many diseases are constitutional, so it behoves the grower to be most careful in procuring his stock, as many of the diseases are not visible in the young plant, but appear during the winter months. These diseases will be dealt with in Chapter XIII.

If young plants are propagated from a parent that splits its calyx, they, in like manner, will invariably split their calyx. If the parent plant is weak in growth, so will its offspring be weak. If the stock has been highly fed with ammonia or unsuitable artificial manure to any great extent, the plants are sure to deteriorate, in spite of care and skill. If the plants lack vigour through the ravages of insect pests (thus becoming open to the attacks of disease), or have been grown in too high a temperature, it is only courting failure to propagate from such stock.

The plant which is precocious, and produces a crop of bloom early in the autumn, is not necessarily the best type of plant for stock purposes. I prefer those which are distinguishable during the summer by their short, compact growth and healthy appearance, and produce a continuous crop of bloom.

SEASON FOR PROPAGATING PERPETUAL-FLOWERING CARNATIONS
AND PERPETUAL MALMAISONS GROWN UNDER GLASS

In years past autumn-rooted cuttings were looked upon by some as being superior to winter cuttings. In the case of the old English Tree Carnations this may have been so, but all the best wholesale growers in this country are agreed that December is quite early enough to commence propagating the modern Perpetual-flowering Carnation. Finer and better plants are procured from stock propagated in December, January, and February than from cuttings rooted from September to November, although in the North of England and Scotland autumn propagation is favoured. The reason why winter propagated cuttings are best is easily explained. A young carnation is in its weakest state when it is emitting roots. It will have almost exhausted its strength during the operation, and hence will require favourable climatic conditions to enable it to recuperate and start out upon its new life.

Those who watch plant life closely know how, in the early days of January, there comes that reawakening into a stronger growth, which is particularly noticeable in the Perpetual-flowering Carnation. This is a factor to be considered well. On the other hand, a cutting inserted and rooted during September has two dull, dreary months before it, from a growing point of view, just at the critical time when it needs most assistance. I know that many people place these autumn-rooted cuttings on shelves in a moderately warm house, and so encourage them to grow. Sometimes they even place them in heated frames. I would prefer June and July rooted cuttings of Perpetual Border Carnations which are to winter and grow in the open garden.

The propagation of *Dianthus Allwoodii* is the same as the Perpetual Border Carnation, except that I do not advise anyone to cultivate *Allwoodii* in pots under glass for propagation purposes, but only for forcing. Such stock is most unsuitable for propagating, being exhausted; also it is natural for *Allwoodii* to rest in the winter.

HARDY PERPETUAL CARNATIONS AND ALLWOODII, ETC., GROWN
OUT OF DOORS—CUTTINGS

First, realize that the cutting will reproduce the parent plant and its conditions at the time it is taken off in habit, health, colour of flower and, in fact, in all details. A cutting removed from a plant which is dry at the root rarely takes root. The old growers used

to prefer the base cuttings—that is, those which are produced from the main stem of an old plant just above the ground; but experience has taught me that these are in no way so prolific as those produced higher upon the flowering growths of the plant—indeed, if the stiff, half-dormant cuttings are taken repeatedly from the base of the plant or branch, they will eventually produce little or no bloom, but an abundance of fine foliage and useless cuttings.

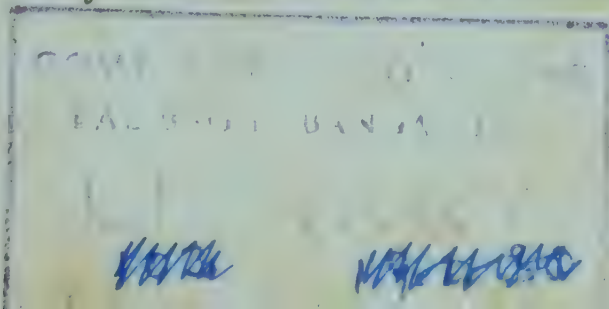
Likewise, the thin top cuttings, which have a stem before the first set of leaves, as seen in Fig. 7, should be avoided, for they will never make a strong, shapely plant, but will produce an abundance of small flowers with weak stems.

The correct cutting is found between these two extremes, and is that produced on the flowering growth where it is thickest, and where there is a short space between the leaves.

As a rule a cutting is ready to be taken from the parent plant when the bud is just bursting, but this cannot be taken as binding, as each variety has its own peculiarities, and some do not produce cuttings until after the flower has been cut, as seen in Fig. 9.

The heel cutting (Fig. 8) should be taken off with a gentle downward pull, and should come away with a small portion of bark from the flower stem intact. This should be trimmed off with a sharp knife, but if it comes away without any of the main stem, it can be taken that it is too soft and will not root. If, on the other hand, it comes away with a long tail of bark from the flower stem, it is too hard. All this will be easily learnt by experience. To imagine that the top of any vigorous growth is a cutting is wrong, for whilst it can be taken off as a piping and rooted, it will never make a good plant, simply because we do not get the complete growth but only a part, or, in other words, the top of the shoot. I wish to warn readers against using the tops of young plants as cuttings. This is one of the most ruinous practices I know, for such cuttings can only produce weakened, disease-ridden plants. No matter how healthy the tops may look, they are useless as cuttings, and when the young plant has to be stopped, the tops should be destroyed.

In the case of Perpetual-flowering Carnations many of the choice varieties will not produce cuttings until after the flower has been cut, and where many thousand cuttings of these are required, special plants have to be grown purely for propagating by removing the buds so as to induce the plant to produce cuttings. With this class, cuttings are taken in the old way, employed for pinks and their hybrids—viz., by piping (see Fig. 8), which is simply to pull them out at a joint; but, again, it is only when the wood is in a correct



condition that they will pull out at a joint, so that the joint is exactly halved in the operation. A preferable method is to cut close under a joint with a very sharp knife, as illustrated. In short, correct wood for propagating is that which is in a half-matured state.

A shoot or growth which has run off for flower—"spindling," as we term it—is useless as a cutting (see Fig. 10).

The average cutting in the majority of varieties is from 2 to 3 inches long in carnations, and from 1 to 2 inches in Pink Hybrids, and should have about four fully developed leaves. A knife is only used to trim off the short curly leaves for about $\frac{3}{4}$ inch up or to remove the small tail of bark on the heel of the cuttings, and in the piping cutting just to shorten back any leaves which would touch the sand. For this the knife should be as sharp as possible.

To massacre the plants simply for cuttings is folly, for this leaves them in a depleted state. It is impossible to get a maximum number of both cuttings and flowers, because if the cuttings were not removed they would eventually flower. Most plants average twelve cuttings each; but do not remove more than three cuttings from one plant at the same time, thus never distressing them nor causing a check.

Many of the old growers used to make their cuttings by cutting them under the joint, and then splitting them up for $\frac{1}{4}$ inch or so; they also used to cut half the leaf away. All this is now looked upon as antiquated by the best growers, as it has been proved to be an inferior method, besides taking longer to carry out.

ROOTING MEDIUMS

Many different materials can be used as a medium in which to strike carnation cuttings. Sifted coal ashes or pulverized cinders mixed with sand may be used. Peat and sand; cocoanut fibre or ground sphagnum moss and sand; even wood ashes and sand, or loam and sand, are quite common; I prefer the latter for summer propagation in cold frames. But whatever is used, it must be perfectly sweet, or the scourge of the propagating bench, fungus, will destroy all efforts. I am a strong believer in sharp, clean sand free from any decaying matter, and of a medium texture, in which to root cuttings during the autumn, winter, and spring. A good grade river sand is difficult to improve upon. Some may think that pure sand would have a weakening effect upon the cutting, but in practice this is not so. On the contrary, the cutting keeps much fresher in it; hence rooting with less effort and a minimum amount of check.

Correct cuttings rooted.



Where to get a correct cutting.



Inferior rooted cuttings which cannot make good plants.



An exhibition Border Carnation
raised by Mr. Douglas.

It will probably occur to the reader that if a cutting is rooted in sand, as soon as it commences to make root it has nothing to feed upon. That calculation is sound logic. But again, if a cutting which is rooted in sand and loam makes four or five separate roots to start, whereas one rooted in pure sand makes seven to ten, the odds are that the latter will make the better plant, and that is exactly the case. Do not allow the cuttings to grow in the sand; pot them off when rooted.

I make it a rule never to use the same sand twice for propagating purposes, fresh sand giving the best results.

HEAT FOR PROPAGATING GREENHOUSE CARNATIONS

Bottom heat is not absolutely necessary for rooting carnations; in fact, old growers used to think that better plants were produced if no bottom heat was used. But with slight bottom heat for rooting cuttings from September to May undoubtedly better results are obtained, though ten degrees more bottom heat than top temperature is quite sufficient; in fact, more would be harmful.

Bottom heat does not draw the roots, as is sometimes supposed, for the emission of roots is a natural function on the part of the plant. Root formation and root growth, like top growth, is more rapid in a high temperature than in a low one, but, as the carnation loves coolness, it cannot stand forcing beyond its natural temperature, and therefore it should be grown in a cool atmosphere. By having ten degrees lower top heat than bottom heat the top growth of the cutting is kept almost stationary.

It is unnecessary to deal with propagating with a high bottom temperature, for it will at once be seen by all observant growers that while the greater heat is quicker, it naturally excites the cutting more, and hence must weaken it. The object should be to prevent the cutting from growing while it is rooting.

Twenty-one days is the minimum time in which I have known a carnation cutting to root under correct conditions, whilst twenty-eight is the average. Odd varieties will take thirty-five days.

HARDY PERPETUAL BORDER CARNATIONS, ALLWOODII AND PINKS

The same applies equally in the case of Hardy Carnations, except that they are propagated during the summer, when the greatest difficulty with which the grower has to contend is excessive heat from the sun. A greenhouse where they can be effectively shaded or a

frame in a semi-shady position is excellent, but if the greenhouse or frame is in full sun, a double shade is necessary. The first should rest upon the glass and be kept damp to keep the glass cool; the other should be 6 inches from the glass in order to check the sun's rays.

It is necessary to remember that when propagating cuttings in cold frames half soil and sand is best. Coal ashes or, what is still better, ashes from garden refuse placed at the bottom will keep worms from working into the soil and sand, and thus disturbing the cuttings.

ATTENTION TO CUTTINGS

It is not difficult to define clearly what should be done, and how it should be done, in the matter of removing and making carnation cuttings; but it is more difficult to lay down rules for after-treatment, because the successful propagator does not work by rule of thumb, but is guided by circumstances. The experienced grower can tell by the appearance of his cuttings if they are right or not and in what stage of rooting they are, and he avoids, rather than rectifies, trouble.

On bright, sunny or windy days evaporation is very rapid, and the cuttings often suffer if not adequately shaded. Many growers fall into the error of repeatedly spraying the cuttings overhead to counteract this. They may go to extremes in this matter, although a dew overhead is necessary in very hot weather.

CARNATION PROPAGATION IN A NURSERY

A description is necessary of how carnations, etc., are propagated on an up-to-date commercial establishment. The keynote of successful propagating is cleanliness; one must remember not only to use clean sand, but the importance of the entire house and frames being free from decaying matter and stagnant water. The cutting should be rooted with as little check as possible, so that when it is taken out of the sand it is as strong as when it first entered. Almost any ordinary heated greenhouse will do in autumn, winter, and spring, and a cold frame in summer so long as it has a heat of 50 to 55 degrees for winter propagation,.

Cases in the propagating houses for use in the case of difficult varieties during the winter are 7 inches deep at the back and front, rising to about 2 feet in the centre, and $3\frac{1}{2}$ to 4 feet wide, so that each forms a sort of miniature greenhouse (Fig. 17). This is to

allow any moisture which rises on the glass at night to run off, and not drop on the cutting. The bottom of the case should be of soft brick or terra-cotta, which will give adequate drainage. The bricks absorb the surplus moisture from the sand, and, in turn, restore it again as the sand becomes drier than the bricks. The bricks themselves rest upon iron bars, but the heat should rise up as much as possible and strike directly upon the bricks. This, of course, is not the only type of case in which carnation cuttings can be rooted, but in my experience it is the best, for average results are not what you should aim at. It must be remembered that this only applies to winter propagation of greenhouse varieties.

Use clean, sharp river sand. Silver sand or any clean pit sand will do, so long as it is free from vegetable, fermenting, or decaying matter, but it will be found much safer to wash the sand well before using it, so as to get rid of any dirt. This is best done by half filling a tub or pail with sand, and then filling it with clean water, and stirring the sand up, pouring off the dirty water. Allow the sand partly to dry out, and afterwards fill the propagating cases or spread it in the propagating case or frame. Water it slightly with a rose, and firm down well. It is most essential that the sand should be firm or the cuttings will fall over when they are watered. When this operation is completed, the sand should be perfectly level on the top. I prefer the sand to remain a few hours, to become warmed through, previous to inserting the cuttings.

To get sufficient artificial bottom heat for your case in winter hang a curtain of tiffany, or similar material, at the front and back of the bench or stage. This should reach to within about 2 inches of the ground. A good flow and return hot-water pipe should furnish the required heat for winter propagation, but on no account should the pipes be less than a foot from the bottom of the case, as that would give an uneven and burning bottom heat, drying out certain parts of the case too quickly. All the artificial heat is directed, in the first place, to the underside of the case by means of the curtains before mentioned, thus providing the necessary bottom heat, and giving a cool, fresh, top heat.

Speed in propagating is one of the secrets of success, and remove all cuttings in the early morning when perfectly fresh. As you take them off, you should place each handful in an air-tight damp box, never allowing the sun to get to them. As each box is filled with cuttings they are moistened and placed in a cool, damp shed, where they are prepared for insertion into the sand.

When propagating in cold frames in the summer I do not follow

the old way of putting the cuttings into the sand. I never use a dibber except when rooting the cuttings in pans, but I moisten the sand with a fine rose, and get a straight-edge 2 inches broad and as long as the frame. I place this on the sand, holding it firmly with the left hand, and draw a line (using an old table or putty knife) about $\frac{1}{8}$ inch broad and $\frac{1}{4}$ inch deep, to receive the cuttings. If these are a little mixed in size, it is best to put the small ones at the end of the rows, or when using 6-inch pans or pots place some round the sides in order that they may obtain more light. Take the cutting between the first finger and thumb of the right hand, putting it about $\frac{1}{8}$ inch deep into the bottom of the furrows, and close the sand upon it on the right side (the side away from you) with the second finger, leaving $\frac{1}{2}$ inch between each cutting, until the row is completed. Do not try to see how many cuttings you can get into a small space. Then take the straight-edge, placing the edge near to the base of the cuttings upon the left side (the side nearest to you), to push it gently so as to close the sand upon the base of the cuttings, and so on (see Fig. 20), until you have put in six or eight rows. Then water with a fine rose, until the sand is run smooth at the base of the cuttings. After this a thorough watering should be given, so that the sand becomes full of water; this is where proper drainage is so essential. The only difference when propagating in pots or pans is that you use a small dibber.

During the first few days the cuttings are like cut flowers, and can only take up water to keep them fresh, so that there should be no lack of it in the sand. This will prevent the base of the cuttings from drying while forming a callus. After this has formed, the cuttings are not so readily harmed.

The whole secret of carnation propagation lies in keeping the cuttings perfectly fresh, without excess of moisture on the foliage. This is easier on dull than on bright days.

Light, heat, moisture, and air have to be controlled by artificial means, but to go to the extreme in any of these matters is as bad as ignoring them.

In propagating it is essential to have a proper system of labelling, in order to avoid mixing, not only in the propagating pans, but also when the cuttings are removed from the plants.

When the cuttings are in the propagating-house frame or case, keep them close for twenty-four hours, and after this close treatment afford them a little air each morning, from two to four hours, according to the weather. Be guided by the moisture upon the foliage which rises at night, but on no account allow the cuttings



Modern hybrid *Dianthus* in a bed.



Dianthus in an allotment.

to wilt. After twenty days of this treatment commence allowing a little air in the house or frame daily. This is gradually increased, until finally, after the cuttings have been in the sand or soil and sand thirty or more days, according to the variety, and the length of time it takes to root, the glass is removed entirely, and the cuttings are hardened off to withstand light and air. Finally, before the cuttings are lifted for potting or planted, they are hardened to the normal light, airy atmosphere of the ordinary carnation house, or in the case of outdoor varieties, rooted in cold frames, they are hardened to outdoor conditions; of course, if a variety is rooted in a pan, it can be moved when rooted, which is an advantage. The aim is to root your cuttings from the first in as low a temperature as is consistent with their health. Only shade when necessary to prevent them from wilting, and give them all the air possible.

If the cutting receives a thorough watering-in, and has mild bottom heat, it will be found that little watering or sprinkling overhead will be required for the three to four weeks it takes to root. But, on the other hand, with these being rooted in pans, if the sand dries out, do not hesitate to water again, because if the base of the cutting once gets dry, it rarely takes root, and never becomes a strong plant.

Admit air if the heat rises above 65 degrees. Watch these details, and so grow your cuttings as Nature herself would demand. The progress of root action is readily seen by the curl of the leaf, which expands flat, and resumes a natural appearance when sufficiently rooted.

When lifting rooted cuttings, if one is found not to have rooted, or has only apologies for roots, it should be thrown away, as it will never grow into a strong vigorous plant, even if replaced in the sand for a second trial.

Do not allow the rootlets to attain much length in the sand. If taken up when moderately rooted, they come away from the sand very readily and without injury, being then disposed in a natural position around the base of the cutting, with no tangled bunch of tender feeders. What little sand adheres to the rootlets allow to remain on (see Fig. 12).

The foregoing will give an idea of how to handle your cuttings. Much of what I have written does not strictly apply to the amateur, yet I feel that he will gain a sufficiency of information from studying the commercial system. With many thousands of valuable cuttings everything must be done to assure perfect success down to the minutest details. The method of not unduly wetting the foliage of

the cuttings is a great preventive of many diseases. To sprinkle a carnation continually is to destroy the bloom upon its leaves, and so make it more susceptible to disease.

PROPAGATING FOR AMATEURS

The best means of propagating carnations for amateurs is to have a small span-roof propagating frame or box (see Fig. 18), or even a large pot or box with a sheet of glass over the top will do. At the bottom should be placed iron or wooden rails, upon which a layer of soft bricks should be laid to form the bottom. The sides of the frame should be 12 inches deep, which will allow the cuttings to be clear of the glass. The roof should consist of separate pieces of glass, so that air can be given as required. The warm end of an ordinary greenhouse, provided the light is good, is ideal for propagating carnations in winter.

For the amateur who is rooting carnations in small quantities, well-drained propagating pans are undoubtedly the best (see Fig. 19). These should be 4 inches in depth, which will allow ample room for crocking, with a layer of sand 3 inches deep. The advantages obtained by using pans instead of small pots are manifold. A much larger body of sand is obtained for use, which does not dry out so readily; it is also possible to make the sand firmer and more compact than when pots are used. In cases, however, where it is found necessary to use pots, it is best to use 5-inch pots, with 2 inches of drainage at the bottom. Cover the drainage with a thin layer of fibre, and fill the pots to within an inch of the top with pure, clean sand.

The cuttings should be dibbled in $\frac{1}{4}$ inch deep and $1\frac{1}{2}$ inches apart. Take great care when inserting them that the base is resting well on the sand. Gently but firmly close the sand on the base of the cuttings. Give the pots or pans a good watering overhead to settle the sand well around the cuttings. Finally, allow them to drain for a few moments before placing them in the propagating case.

It is important that the pans or pots should be plunged up to the rims in ashes or cocoanut fibre for summer propagating to prevent them drying out. It is most important to shade from the sun, and never to allow a draught to blow in upon the cuttings. A good light is most essential. As soon as the cuttings are callused, admit air by degrees, and eventually remove the glass altogether.

It should be remembered that different varieties at different times of the year take different lengths of time to root, hence it is better for the small grower to have his individual varieties in separate pots, so as to enable him to remove them from the frame as they become rooted.



A small commercial propagating house.

17



An amateur's propagating frame.

18



Cuttings rooted in
a propagating pan.

19



Cuttings ready for lifting from the sand.

20

In this country, with its weak winter light, causing a soft growth, it is a good plan after the first week for the cuttings to be protected from the air only during the day by covering the case inside the greenhouse with glass, this being removed at night, and put on later each day until, after twenty days or so, it is unnecessary.

There is yet another way for the small grower to propagate his carnations—namely, by the use of a hotbed. But this method should only be used during the late spring and early autumn, on account of the frosts. Yet the old-time horticulturist used this system to good advantage, particularly during March and April, by placing the cuttings in pots, and placing the pots in a mild hotbed. Sixty to seventy degrees should be the temperature to commence with in the bed, but always remember that a little niche of ventilation at the back will let out any gas.

Some private growers simply put the cuttings into a pot in a sandy compost, and place the same in a cosy corner, sprinkling and shading daily; but we all know wonderful people who appear to have a charm over cuttings, and stick them in any old spot in the garden or greenhouse where they root and grow freely.

In using a dibber to put in the cuttings, it should be remembered that the bottom of the dibber should be the same size as the base of the cutting, and the cutting must rest upon the sand. Many cuttings are bruised whilst being firmed in.

PROPAGATING PERPETUAL CARNATIONS BY LAYERING

This method is rarely adopted in carnation nurseries for any carnation except the old types of Border and Malmaisons, but is often favoured in private establishments. The great value of layering is that a growth layered builds up constitution and vigour, so making a robust plant. The summer months are the most favourable, and the young growths from 4 to 5 inches long should be selected; these will require stopping as soon as the layer is rooted. The common practice is to lay the plants down in a frame or out of doors, as described in the chapter on Border Carnations, which deals with layering.

PROPAGATING FROM SEED

At present it is not possible to raise Perpetual-flowering Carnations true to colour from seed, for there is no variety that reproduces itself from seed, although many interesting plants are obtained when the best seed is sown, as described in Chapter XVIII.

CHAPTER III

SOIL, COMPOST, AND POTTING

SOIL is not so much dirt but a highly complex body. Far from being an inert, lifeless mass, it is most emphatically a thing of life, and must be treated as such. If we are growing any high-class plant like carnations, and aim at the best results, the best loam will always prove the cheapest.

A great deal also depends upon the individual, for it is important that he should endeavour to understand the peculiarities of his particular soil thoroughly, and learn how to get the best out of it.

CARNATION LOAM

A good loam contains potash, phosphoric acid, nitrogen, lime, and so on—in fact, all the necessary elements of plant life. This is generally understood, but the selection of loam is governed too frequently more by its appearance than any other factor.

The results which are obtained from the various soils of differing textures and density, urged in carnation cultivation, vary enormously. Black, sandy, peaty soil is, perhaps, the worst with which the grower has to contend. It lacks body, and cannot hold, for any length of time, any enriching addition given it. Yet excellent carnations have been produced in this soil. Gritty soil is, in the majority of cases, bad for pot cultivation, for it is always at one or the other extreme of moisture also. It is low in plant food, and unless it is judiciously intermixed, and built up with carnation food and other soils, it is of little worth. The heavy clay soil is another extreme. It can be made to produce the best carnations for pot cultivation, but it must be harvested in dry weather, and only the surface which has been subject to aeration and freezing will possess any quantity of available plant food. It should be mixed with coarse sand and long manure to keep it open, and the surface should never be allowed to become sealed.

It is generally conceded by the best carnation growers that the ideal soil for carnations is a silky, semi-sandy loam, which feels

smooth when rubbed between the fingers and thumb, and is sufficiently light in texture to afford free and ready drainage of any surplus moisture, yet with sufficient body to retain the available plant food. It should possess vegetable fibre. As a rule, such loam is light brown in colour, and invariably is very evenly balanced in the essentials of plant life, and hence will not require to be greatly enriched.

SOILS FOR CARNATIONS OUT OF DOORS

Carnations out of doors are not exacting in soils, and will flourish in all the various textures of soils if the following simple advice is observed. In the case of very light, sandy soil, which as a rule is poor and lacks plant food, autumn and early spring planting is advisable. The advantage of light soil is that the plants have a free drainage during the winter, and commence to grow earlier in the spring. A heavy dusting of pulverized limestone dug into light soil gives it substance, while a top-dressing of an approved carnation food, given from April to September, also hoeing the surface of the soil once each week in bright, dry weather, will help the roots to keep cool and moist; in fact, better results are obtained from repeated top-dressings and hoeing than from digging in large quantities of yard manure.

In the case of heavy clay soils it is better if deeply dug or bastard-trenched in the early autumn, and left as rough as possible, so that the winter frosts can pulverize it, while a dusting of limestone will help to break the soil down. Old yard manure or other enriching medium is best added when the surface of the soil is lightly forked or Canterbury-hoed over in the spring. In heavy soil all seasons are favourable for planting, with the exception of late autumn and winter.

SOIL IN A TOWN GARDEN

The soil in an old town garden is often sour and infested with earthworms through lack of cultivation. This soil only wants correct treatment to make it ideal for carnations and Dianthus. A dusting of limestone is the most valuable addition.

The soil is best enriched during the spring and summer with carnation food, hoeing the surface of the soil during bright, dry weather being of the greatest possible assistance to the plants.

HARVESTING LOAM

The best soil for growing carnations under glass is procured from high-lying ground, where there is a free drainage. That from low-lying swampy land is inclined to be sour, while that from the top of

a hill, as a rule, is not rich. The soil between these two extremes is to be preferred.

A rule that stands good without any exception is that no kind of work necessitating the moving of soil, whether it is digging, ploughing, or harrowing, must be attempted when soil is wet from recent rains.

Soil intended for use during spring and summer in the greenhouse should be cut in the previous September or October in sods from 3 to 5 inches thick, according to the depth of the fibre, and then stacked in a long heap, some 6 feet broad, and not more than $4\frac{1}{2}$ feet high. If manure is stacked with it, put a $\frac{1}{2}$ -inch layer of manure to every 4 inches of loam. The heap should be left until December, when it should be well turned, and the manure incorporated with the soil. The heap should be turned again in the early spring, when it will be ready for chopping down for use as required.

THE METHOD OF PREPARING SOIL ON A NURSERY

The grower with plenty of land around his nursery or garden will save much labour by preparing the soil in the field, where he can plough or dig it or add manure if necessary; upon heavy soils a dressing of lime is essential. The important point of early ploughing should be observed, for this exposes the soil to winter and spring frosts, thereby mellowing it and destroying many insect pests.

Soil, if prepared in the field, can be brought to the houses ready for immediate use, thus avoiding much expensive hand labour.

Plough a portion of a meadow to the depth of 4 inches in the late summer, sufficient to supply the season's wants. Select a dry spell during the winter to give a heavy dressing of decayed farmyard manure, and plough the piece crossways. If sand is required, give a suitable dressing. Afterwards pulverize it with a harrow. The piece should be harrowed each fortnight until required, to destroy the weeds, but this must only be done in suitable weather.

HUMUS

Possibly no one factor influences the water-holding power of soil more than humus. It also appreciably affects the general physical condition of the soil, and in its decay it causes potash and phosphoric acid to be made available to plants. The various essential elements of plant food may be supplied in inorganic forms, but unless humus is present to regulate the general physical conditions and to supply the essentials for the breaking up of the insoluble salts in the soil, vigorous plants cannot be produced.



Dianthus Allwoodii in the rock garden.



A specimen two-year-old Perpetual - flowering Carnation.

There is not any doubt that animal manure, besides imparting fertilizing properties to the soil, is also of mechanical benefit, making the soil more porous and open.

For carnations, manure, like loam, can be too old. If it will break up readily, it is in a fit condition to use. Always try to stack yard manure, particularly cow manure, under cover, to protect it from the rain and avoid leakage.

The common rule, that horse manure with a good proportion of straw is the best for heavy soils, and cow and pig manures for those of a lighter texture, holds good.

It must be remembered in discussing the quantities and qualities of manures that there is a wide difference, not only in the chemical properties of soils in different localities, but in the condition of soils of the same qualities. A meadow that has been used as a pasture for innumerable years, and which has fed cattle, is richer in plant food than that which has been laid down but a few years, or one which has been used as a hay-field; hence less manure will be required for the former. The amount of manure used for carnation potting varies from one in eight to one in four of loam.

WOOD AND GARDEN ASHES

I advocate the addition of wood and garden ashes, particularly in the case of very heavy soils. They materially improve the mechanical condition of the soil. In practice everything within reason which will burn and produce good ashes should be burnt. These ashes should be stored in a dry shed, and used with soil at the rate of one in ten. I consider it almost equivalent in its usefulness to wood ashes, and much cheaper, while all ground top-dressed with it will benefit greatly.

LIME

Most soils are short of lime, which is a potent part in a carnation compost. This may be added in the form of pulverized limestone, mortar rubble, chalk, or as air-slaked lime at the time of final mixing. This should be added at the rate of about one in twenty of the compost.

POTTING COMPOST

Owing to the various grades of soil, it is impossible to give exactly the best compost for carnations, because circumstances alter cases, but, as a general rule, on an ordinary sample of soil, the following mixtures will be found the best.

The compost for the first potting of rooted cuttings into 2-inch pots should be: two-thirds maiden loam, one-sixth sand, one-sixth garden ashes, all being passed through a $\frac{1}{8}$ -inch sieve.

Some growers add bone meal to all their mixtures of soil, but if, when established, the carnations are manured with an evenly-balanced carnation food, it will be found cheaper and better not to add this ingredient. It is not the most elaborate recipe which makes the best dish, nor is it the most elaborate compost which grows the best carnation. An old horticultural sage once cursed the sieve, and he was right. Rarely, if ever, should it be used in carnation growing, and certainly never when potting into large pots. Knock the loam or manure to pieces with a fork, or chop it up with a spade; in fact, do all possible to avoid using a sieve, which only holds back the best of the soil.

The compost for the second potting for plants from the 2-inch pots to the 3-inch pots should consist of three parts good maiden loam, one part sand, one part old manure, one part garden ashes, all being passed through a $\frac{1}{4}$ -inch sieve.

The compost for all succeeding pottings should be: three parts maiden loam, half part manure, one-eighth part garden ashes, one-eighth part mortar rubble, and sand added according to the texture of the soil; do not sieve this compost, but break it up finely with a spade and well turn to incorporate the whole of the ingredients.

POTTING

One of the most important points in potting is to have everything ready—potting bench firm, soil in the correct degree of moisture, pots close at hand.

I will take first the potting of a rooted carnation cutting into the 2-inch pot. Take a pot in the left hand, and simultaneously brush the loose soil away with the back of the right hand. Pick up a cutting with the left hand, and at the same time scoop up a handful of soil in the right hand. Holding the roots in the pot, not quite as deep as they were in the sand, as they will press down, give them a slight shake to make them hang naturally. The soil is then filled in around them, and with the thumb and first finger of each hand press the soil firm round the pots. Give the pot a tap on the bench, and it is completed.

In potting a plant from the 2-inch pot into a 3-inch do not crock, because so small a pot is stood upon an ash bottom, and therefore it has sufficient drainage. The plants are knocked out of



Perpetual-flowering Border Carnations in a small formal garden.



The advantage of growing
Perpetual Carnations in beds.

the 2-inch pot, care being taken that there is no dryness at the roots. A little soil is placed at the bottom of the 3-inch pot, so that the top of the plant to be potted, when in position in the centre of the 3-inch pot, is level with the top of the pot. The spaces at the sides are filled with the fine potting compost, and some is piled on the top. The ball of the 2-inch plant is firmed into the soil, using the first finger and thumb of each hand. If the repotting is correctly done, there will be about $\frac{1}{4}$ inch space left for watering, and the surface soil will be quite loose.

In potting a 3-inch plant into a 5-inch pot the larger pot should be well rubbed down with a dry cloth, also well crocked. The actual process of potting is similar to that of the 3-inch pot, except that there is a larger space for soil between the ball of the 3-inch plant and the 5-inch pot, so that when this has been filled with soil, it is essential that the pot is given a sharp tap upon the bench to shake the soil down. Afterwards the thumb of each hand should be run round the side of the pot to firm down the bottom soil a little, and make sure that no lumps are holding up the soil and causing a cavity. The pot should then be filled up to the rim with soil again, and be given several sharp taps upon the bench, and the plant is potted. Some recommend the use of a stick or rammer to firm the soil round the sides, but the whole soil is firmed much more evenly by sharp taps upon the bench.

In potting into larger pots than the 7-inch, the bulk of the firming has to be done with a rammer, because it is impossible to tap large pots on the bench to firm the soil; but an excess of ramming compresses the soil too much, particularly towards the top of the pot, where the surface soil should be left loose, this being gradually firmed down by the watering.

The actual amount of firming to be done greatly depends upon the texture of the soil. In the case of a light, sandy soil, it is difficult to get it too firm, while heavy soil is quickly spoilt by overfirming.

A golden rule in potting is never to use soil that adheres to the operator's hands. It will be too wet, and the plants will not grow away freely in it.

STERILIZATION OF SOIL

Unless the soil is badly infested with pests, sterilization of soil for carnations is hardly necessary, unless in the case of special varieties of seedlings. Where it is carried out it can be performed by baking or heating by steam; the latter undoubtedly gives the best results.

In the sterilization of light and medium soil, which has been heated almost to the temperature of boiling water by the injection of steam from a high pressure, it has been found that when the soil is thus cleared of harmful agencies the ammonia-producing bacteria increase rapidly, and there is a considerable increase in the production of plant food from the soil and manure employed, followed by an increase of crop of a more healthy character.

The usual method of sterilization is to build a large wooden bin, about 4 feet wide, 10 to 15 feet long, and 3 feet deep, with one side hinged, so that it can be let down to shovel out the soil. Iron pipes should be run along the bottom of the bin, a foot apart, lengthwise. In a 4-foot bin there will thus be three pipes, each with $\frac{1}{16}$ -inch holes drilled in their side, about 1 foot apart. Of course, the pipes must be connected outside the bin and joined to the steam boiler, which can be done with a rubber pipe. Fill the bin loosely with soil, and place on the surface two or three potatoes. When these are cooked the soil has been sufficiently heated. Cover the whole with closely fitting sacks or similar material, to keep in the steam, the latter being turned on at about 80 pounds pressure per square inch. If this is properly done, it destroys all nematodes (eelworms), grubs, and all plant and animal parasites likely to attack the growing plant roots. All organisms of an order higher than bacteria will be killed off, and certain organisms which normally limit the number of bacteria in the soil are destroyed.

The destruction of all weeds and seed relieves the cultivator of a good deal of work in keeping them down. I think also there is a general agreement that sterilizing by steam is vastly preferable to "baking," as the roasting or baking of the soil to a state of absolute dryness has an injurious effect, creating an excess of potash, and thus rendering the soil unfit for plant life; on the other hand, steam sterilization makes heavy clay soil too wet to use for several weeks.

From the foregoing it will be seen that unless the soil is badly infested with pests, sterilization of soil for carnations is hardly necessary, unless in the case of special varieties or seedlings.

CHAPTER IV

GROWING YOUNG CARNATIONS AND HYBRID DIANTHUS

THIS chapter deals with the attention that must be given to all races of young carnations during the various seasons of the year. In the autumn young plants of Hardy Carnations may be planted immediately in the garden after rooting, but such a practice cannot be advised.

The influence brought to bear upon the early youth of plants seals, to a very large extent, their destiny. A cool-grown, hardy young carnation may not have quite so attractive an appearance to the untrained eye as stock potted in very rich soil and grown in an abundance of moisture and heat. The latter will make a heavy, soft growth, which too often misleads the inexperienced; it is like comparing a spoilt boy with an athlete. To obtain the best results from Perpetual Carnations, it is imperative to commence with good stock, and this can only be obtained by normal treatment.

As I have already pointed out, previous to potting or planting the rooted cuttings they should be hardened to withstand light and air so as to minimize the check. It is most essential that a young carnation should be grown in a strong, direct light; and if the cutting has been rooted hardy and cool, only slight shading from the strongest sun in a greenhouse for a few days is required, while it is never wise to allow them to be in a great heat or to lack air even when freshly potted.

LIFTING THE CUTTINGS

The cuttings must be lifted from the sand with care. A thin piece of wood about 2 inches broad is the best implement to use. This will not injure the tender young roots. Place the rooted cuttings in a damp box, only taking up a few at a time, so as to avoid injury from exposure to the air.

POSITION FOR YOUNG PLANTS

The best care and the best position in the house or frame is none too good for the young carnation stock. It is folly to select the best cuttings and take every care in their propagation if this good

work is to be destroyed later. Too often the young plants are looked upon as a sort of necessary evil, and, being non-productive of bloom, are crowded into any out-of-the-way place regardless of surrounding conditions.

It is not wise to pot the young carnations off into too airy a position. A small greenhouse or frame with a temperature of 45 degrees at night is best. Failing that, in the case of small quantities they can be put back into the propagating case, or a sub-propagating case, for a few days until established. The ideal position for growing young carnations, when established, is one receiving full sun and an abundance of air.

SOIL FOR YOUNG CARNATIONS

No matter what type of carnations is grown or under what system, a similar soil will be required, the foundation of which should be good loam. What is termed stiff yellow loam is best, but, failing that, practically any maiden loam will do. This matter is fully dealt with in Chapter III.

Soil for potting carnations is in the correct condition for use when just moist enough to press into a ball with the hand, but not so moist that it will not crumble readily when broken up. Root action is encouraged best in a moderately moist soil—one which entices the roots to search for moisture. Care should be taken to have the chill off the soil before using it. This is easily done by allowing it to remain in a warm shed or greenhouse for a few hours.

POTS AND POTTING

The young roots do not take hold of the soil so readily during a dull season, so a small pot for the first potting is a vital point. A 2-inch pot is ample in size for a freshly potted cutting from October to March. This enables the young plant to go straight away with little check and establish itself within three days, but a 3-inch pot is advisable for the rest of the year.

There is more art in potting plants than appears on the surface, especially if speed is required as well as good work. Every good workman has a system, and should work like a clock, hence a sub-chapter is allotted to this art.

Great care must be exercised not to get the cutting deeper into the soil than it was in the sand or it will damp off. Endeavour to have



Dianthus Allwoodii set in
beds in the middle of a lawn.



Typical blooms of *Dianthus Herbertii*.

the potting bench in the house where the cuttings were propagated, or else in a shed free from cold draughts.

After potting, the young plants are best stood on ashes and given a little space between the pots.

WATERING YOUNG CARNATIONS

The correct watering of plants in itself is quite simple, yet it is one of the most difficult arts for a beginner to learn. The secret is only discovered by observation. The expert knows by a glance at a plant whether it requires water or not, and also exactly how much it requires.

After a carnation cutting has been potted, it should receive sufficient water to penetrate to the bottom of the pot. After that, water should be given only when the soil shows signs of getting dry.

It is advisable to damp down or moisten the house or frame, also to spray the young plants overhead on very bright, drying days, but I am no disciple of this perpetual damping down and overhead spraying. It only encourages a soft growth, and is not natural to the plant. If the young plants are saturated with water they will receive a check, and remain stationary for several days. The watering should be about sufficient to reach the bottom of the pot in an hour later the operation.

SHADING YOUNG CARNATIONS

One of the mistakes made with young carnations is that, as a rule, they are shaded and generally coddled far too much. If the cuttings are hardened off before potting, and the freshly potted stock receives sufficient water in the first place, little, if any, shade is required after the first two or three days, and even then only from the strongest sun.

No sun rays should strike the freshly potted carnation cuttings for a few days after potting. The exact number of days will depend upon how well rooted and matured they were at the time of potting. As long as they are inclined to wilt they must be shaded from strong sun, but the shading should be decreased as rapidly as possible.

The roots should have reached the sides of the pots in three to four days. Then remove all shading, except in the spring, when the sun is particularly powerful, in which case shade for the few hottest hours during the day.

TEMPERATURE FOR YOUNG CARNATIONS

There is nothing to be gained by growing young carnations in a high temperature. A long-jointed, rapid growth is invariably the result. Comparatively few growers realize the great benefits to be derived from growing young carnations in a low temperature. As soon as the newly potted cuttings are sufficiently established to stand the full sun, they should be gradually accustomed to a lower temperature, say 45 to 50 degrees during the day, and 40 to 45 degrees at night, with as much air as possible.

This treatment not only encourages a slow, steady growth, but induces a partial rest; to say nothing of the check cool treatment has upon insect pests.

AIR

Air should be put on the house or frames so long as no direct draughts strike the freshly potted stock. In the spring of the year, with cold winds and a burning sun, this is no simple matter, because at times the grower is placed between the choice of a high temperature or a draught. Under such circumstances it is wise to have a little of both.

POTBOUND AND HIDEBOUND YOUNG CARNATIONS

Young carnations will stand a long time in small pots without apparently suffering, but in reality they do suffer just the same, for the roots not only become potbound, and thus checked, but the stem of the young plant becomes hidebound, and when potted will not commence growing quickly, nor when stopped do they produce so many breaks. There is one thing which must always be kept in mind—viz., never allow young carnations to become checked and hard. This is one of the most important precepts I can give.

POTTING ON

As soon as the cutting becomes established in the 2-inch or 3-inch pot, do not allow the roots to become weak or slow in action for lack of nourishment (see Figs. 27 and 29), but pot on or plant the young plants of Hardy Carnations out of doors before this takes place (see Figs. 28 and 30). During the winter in the case of Perpetual-flowering Carnations and Perpetual Malmaisons, it is advisable to pot from a 2-inch pot to a 3-inch pot, afterwards into 5- or 6-inch pots; some growers pot direct into their flowering pots, but this is not to



The checked root action
of a young Carnation
through need of repotting.

27



A young Carnation spoilt
for want of repotting.

29



A young Carnation
ready for potting on
or planting out.

28



The healthy root action of
a young Carnation which
is ready for repotting.

30



A young *Dianthus* stopped
and ready for planting.

31



A layer of *Dianthus*
Allwoodii.

32



A rooted cutting of
Dianthus Allwoodii
lifted from a frame.

33

be recommended, for it is too big a move, and in the event of dull weather there is a large quantity of soil lying unused round the small ball of the 2-inch plant. This would quickly become sour, particularly if at all wet. Besides this, the plant does not need all this quantity of soil at once in its young state. The one aim should be to succeed in growing a perfect plant, and no extra trouble or expense should stand in the way. Hence build up a strong, stiff, short-jointed, robust young plant by giving it small but frequent moves into a larger pot each time. Soil is dealt with in Chapter III.

Under no circumstances allow insect pests to gain a position. They invariably attack the partially developed leaves, where they are extremely difficult to reach by fumigation or syringing.

CHAPTER V

STOPPING PERPETUAL CARNATIONS

THE great difference between the modern Perpetual Carnation and Perpetual Malmaison over the old form of Border Carnation Malmaison, and Pink, is that the former must be stopped (have the point of the growth removed) and the latter must not, simply because the Perpetual varieties are perpetual growing, and it is advisable to build up a bushy young plant, while the old form of Border Carnation, Malmaison, and Pink only bloom once a year.

THE FIRST STOPPING

Among the difficulties which confront the average grower are when to stop or pinch the top off the plants of Perpetual Carnations, Perpetual Malmaisons, and Hybrid Dianthus, the correct conditions in which to have the young plants for stopping, and where to stop them.

The object of the first stopping is to encourage side growth and so build up a bushy plant, which in turn will produce a large quantity of flowers. Naturally, the more growth that is obtained, the larger the cut of flowers will be. If, on the other hand, the young plant is not stopped, it will only produce a single small flower and break naturally, thus making a long straggly plant.

It is a matter of vital importance that the young plant should be in a vigorous, healthy condition when stopped, and this state can only be promoted and maintained by a free root action. If it receives a check for want of potting, the growth becomes too woody and hard, so that instead of making some four to six strong breaks, only two or three are produced at the top of the plant. These are fed through a hard stem, which naturally means an impeded or reduced food supply.

Again, if the young plant has been shaded or grown in a poor light, the growth will be too soft and sappy, and this, in turn, will not produce the full complement of breaks (see Fig. 35); whilst a plant which has received a reasonable amount of care and attention,

A young plant which has been checked in the small pot and so has turned woody. Note the bare stem and few breaks at the top.



35



A variety which makes natural breaks and should be allowed to elongate before stopping.



A young plant stopped
at the sixth joint and
breaking at every eye.

36

"Long stopping" has
been practised here.



A young Carnation which has
received "short stopping."

37



38

by being grown in an airy position with full sunlight, and potted or planted as required, will have a matured growth which will break at every joint, thus laying the foundations of a good plant.

Some good growers make it a rule never to stop any young plants before early March, claiming that by this means more and better breaks are produced; and there is certainly something to be said for this.

We in England have certain hereditary rules, which we are tempted to apply by force of habit to all classes of plants. Above all things, the Englishman loves a compact, bushy plant with breaks close to the surface of the soil, and while agreeing that such is, as a rule, a token of good craftsmanship, yet, in the interest of the Perpetual Carnation, I maintain that an exception should be made in its case.

The fact is obvious to all that the breaks, or side growths, produced naturally by a young plant, as seen in Fig. 38, are much stronger and quicker growing than unnatural ones produced at the base of the growth (see Fig. 37). A good system is to stop all varieties which can be so treated when the young plant commences to elongate for flower. Sometimes with this method there are 2 or 3 inches of stem at the base of the plant, but in this way you get the strong natural breaks which produce the finest flowers.

Imagine a young plant established in a 3-inch pot or planted out. If it were stopped about 2 inches above the surface of the soil that would be termed "hard stopping." The plant would be compelled to produce unnatural breaks. To stop the plant, say 4 inches from the soil, is medium stopping, but to allow it to elongate for flower before stopping the growth is long stopping, and this, if you are cultivating, as the market growers do, purely and solely for quality of flower, and with no thought as to the shape and appearance of the plant, is the best method. However, I recommend the ordinary grower, who must consider the appearance of his plants to a certain degree, to make medium stopping a general rule.

Regarding the actual stopping itself, there is only one correct way of doing it, and that is to break the lead out with a sideward pull. This is best done in the early morning, when the growth is stiff and brittle. Let me not be misunderstood. I do not mean just to break or pull out the joint of the growth, but to remove the entire top of the plant with a set of developed leaves intact, so that the remaining eyes are in an equal state of maturity, and all break evenly, and thus we commence with an evenly balanced plant.

Some growers advocate using the knife for removing the tops,

but personally I have always found the growths snap off readily; yet sooner than pinch them off with the thumb and finger, I should most certainly use a knife.

Always stop Perpetual Border and *Allwoodii* the second time, because it is better to build up a good bushy plant before allowing it to flower. Of course, it is not necessary to stop all the growths for the second time, but at least some of them should be dealt with (see Fig. 37).

SECOND STOPPING

There is a threefold object in stopping carnations. Stated briefly, it is to encourage continuity in blooming, to preserve and build up the plant's energy, and to obtain a shapely plant (see Fig. 38).

There is no wisdom in allowing plants to make an unnecessary amount of top growth and then to go to them one morning and stop right and left. This not only wastes their energy and causes a check, but it also encourages the plants to crop all at once, instead of producing a continuous supply of bloom during the entire year. It is only natural that if the growths of a variety are all stopped at one time they will flower together. The object should be to go over the plants, say twice a week, only stopping what growths are in a fit and proper condition to be so treated at the sixth joint from the base of each growth as a general rule.

If plants are out in the open it is never wise to stop them during dull, rainy periods, as the growths are very much softer and more sappy, and do not break so evenly or produce so many breaks. It also causes a greater check to the plants.

There is one rule which it behoves all carnation growers to have deeply impressed on their memory. Never pull out the point of a growth. Such stopping is premature, and results in a number of weak breaks. If the growth is long enough to be stopped, break off the top—if not, leave it. It may be asked, when is a growth of sufficient length to be stopped? I say, as a general rule, when one can remove two developed leaves, and leave six good joints or sets of leaves on the branch; but with the long, loose-growing varieties, it is best to pinch the growth in a little harder.

I hope I have made myself explicit. After the young plant has received its first stopping, it produces side growths which should be stopped as they become long enough. If you do not stop them, they produce flowers, so that for winter flowers under glass you continue to stop the growth until July, for garden blooms you do not. Never stop more than one growth on a plant at the same time, because it

is bad for the plant when so stopped. It is better also that it should not have the strain of bearing more than one fully developed flower at the same time.

Now we come to the crux of the whole subject—viz., when to cease stopping, so as to obtain the best results during the winter. The Perpetual Carnation is perpetually flowering simply because it is perpetually growing, but, naturally, the winter growth is much slower than the summer growth, and if it is stopped too late in the summer, it will have too much to do in the autumn to produce bloom by the winter. On the other hand, if it is not stopped sufficiently late, it will produce a quantity of blooms in the autumn, when they are not so highly prized. As a general rule July is sufficiently late to cease stopping the average variety of Perpetual Carnations for winter flowering under glass.

Again, varieties vary, and each requires special study, while latitude also has to be taken into consideration. The best guide is to remember that the actual growth stopped will not produce flowers until some five or six months later.

CHAPTER VI

SUMMER TREATMENT OF PERPETUAL CARNATIONS IN POTS FOR FLOWERING UNDER GLASS

IN the previous chapters the cultivation of the young carnation from a cutting to the small pot has been dealt with. I will now continue with the summer treatment.

It depends upon the time and season of the year as to where the young plant can be grown, and also upon the latitude.

The degree of frost a young carnation can stand without serious harm is doubtful. It is certainly several degrees, but such frost must have some ill effect upon the development of the plant, hence never allow your young stock to have a lower temperature than 45 degrees before May, when the growth is well matured by the sun and air during bright days, and will take little harm. However, make it a rule always to grow your young carnations under glass, whether it is in a house or under frame lights. Of course, in the North of England, where the spring season is a fortnight or so later, further allowance must be made.

The difficulty for the reader at this juncture is the exact position of the young plants. You should commence propagating greenhouse varieties for winter blooming in December, and continue until the end of March, and even later on exceptional occasions. Thus a cutting inserted in the sand on December 1 would be rooted and fit for potting into the 2-inch pot by January 1, and for the 3-inch pot by February 1, when in turn it should be potted on into the 4-inch or 5-inch pot in early March. Now a cutting inserted in January and rooted in early February would grow much quicker, owing to the advance of the season, and be ready for potting on into the 4-inch or 5-inch pot almost at the same time as the December rooted cutting, whilst a cutting inserted in March will root and grow much quicker still, and will require potting on almost every fortnight. That is why it is impossible to give definite rules and an exact calendar of operations, as some would wish, with exceptions made for every dull or rainy day.

When the young plants have established themselves in the 3-inch

pot, and before there is any tendency for them to become potbound, they should be potted on into 5-inch or 6-inch pots, the latter size for general pot culture in the case of good, free-growing, strong varieties. The compost for potting is fully dealt with in Chapter III.

The plants should be stood in a light, cool position, where an abundance of air can be given. A greenhouse in the early season and a frame after the middle of April are excellent.

There is full scope for the skill of the horticulturist in cultivating Perpetual-flowering Carnations in pots during the summer—it is not a difficult task, but the varying conditions require to be efficiently met. The cultivator who closely studies his plants will have them almost double the size in autumn, and obtain double the crop during the winter, compared with the indolent, careless grower.

Potting the stock into its flowering pots at an early date is also an important matter. A well-established plant in the autumn is the one which will withstand winter's weaker light and continue to grow during the dull months. All Perpetual Carnations intended for early winter flowering under glass should be potted into their flowering pots by the end of June. The best position for them after the final potting is in a frame, where they can be protected from heavy rains or stood out on ashbeds in an open position—one that enjoys the full sun from its rise to its setting, except in very wet, cold weather, when they would be considerably harmed. Let the plants be treated generously in the matter of room, because space means ripened growth. The wind is of no assistance to the carnation during the summer, and a position where its ravages are somewhat checked is to be preferred.

The best size of pot in which to flower carnations in the first season is a matter of opinion, and depends greatly upon whether the cuttings were taken in December or March. Early cuttings will produce a heavier winter crop of bloom if flowered in 8-inch pots, and rarely, if ever, have I found it necessary to exceed that size, although there are exceptions.

It should be clearly understood that late September potting does not pay. Mild feeding is to be preferred, provided a good approved carnation food is used.

WATERING CARNATIONS IN SUMMER

The natural season of growth for all members of the *Dianthus* family is the spring and summer, hence the supply of water after the plants become well established must be greater than in the dull season.

Since so much depends upon local conditions, texture of soil, etc.,

it is impossible to give any definite rules upon this matter. In fact, throughout this book I feel that the most I can hope to do is to convey to the reader an idea which by practice and observation will gradually reveal itself to him. Then, when confronted with the real difficulty, he will know how to grapple with it.

The old notion that we are not following Nature's way in watering when the sun shines is without reason, for though the sun is obscured during a rainfall, everything is wet upon its reappearance after the passage of the storm, and everyone has noticed how the growth expands under those conditions.

The amount of moisture given off by the leaves of the plants into the air is much larger than is generally supposed. Scientists have demonstrated that certain plants transpire surprising quantities of moisture through their leaves, and they have estimated that over 75 per cent. of the energy received from sunlight is used to perform this work of transpiration. Naturally, this goes on much more rapidly in bright than in dull weather; in fact, on dull, warm, moist days it is practically stationary. This gives food for thought to the intelligent grower.

Very wet and very dry soil cause the root action of a carnation to stand stationary, and it is the varying degrees of moisture between the extremes which encourage and support a vigorous, healthy growth. A freshly potted plant is readily spoilt if over-watered, owing to the fact that the large body of new soil does not dry out, hence it turns sour and spoils the plant.

Referring to overhead watering, as I have pointed out, this does not injure, but assists, the plant's growth if done in moderation, and if the natural glaucous, or bloom, upon the foliage of the carnation—which is provided by Nature as a protection against fungoid diseases—is not destroyed. It is most important that the plants should be sprayed or syringed during the summer to keep insect pests in check.

Now we come to watering plants out of doors in pots or frames during the summer. As a general rule, if a carnation is dry, its pot requires filling up with water; if not dry, leave it. If in the summer plants are looked over and watered just after the dew has dried off them, then well sprayed, particularly the undersides of the leaves, using good pressure, and sprayed again in the late afternoon, that is all they require when the pots are not too full of roots. Some growers spray overhead at midday. This is of little importance; but a good evening spray in hot weather will keep the plants clean from insects, and do a great deal of good on warm summer nights. In the late

summer or early autumn, if unable to house the stock, no spraying should be done, and watering should be carried out judiciously.

For stopping plants, see Chapter V.

SUPPORTING PLANTS

There is no economy in leaving plants until some branches break before supporting them. A straight shoot invariably grows into a strong plant.

In growing carnations for profit, the practice of supporting plants with sticks and raffia is quite obsolete, simply because it does not properly support the plant, the stronger growths robbing the weak of their allotted space. To get the stems to grow erect, much tying is required, so that the flowers are only cut with difficulty and waste of time. The one drawback of the Perpetual Carnation is the large amount of attention required in the form of tying, and in the spring of the year they are as bad as creepers in that respect.

For plants grown for cut flowers planted out in greenhouses, see Chapter XVII. A network of wire and string is now arranged over the plants, each plant having an allotted space to grow in. This undoubtedly is a great advance upon the old practice of sticks and raffia. Market growers who cultivate their plants in pots follow out this practice. Some stretch a large mesh wire over the plants, running two tiers for the flowers to grow through, while others run wire down between the plants lengthwise, and a double line of string between each row of plants crosswise, so that each separate plant is in a square with the double row of string, keeping a space for air between the plants on the two sides.

The best cultivators are in favour of individual wire supports for each separate plant when grown in pots. These are made in varying styles, and each grower should select the one he thinks is the best. A well-supported plant is invariably a healthy plant, while a straight stem produces the finest flower and a smaller percentage of split calyx. Although, of course, the first cost will naturally enter into consideration, it should be kept subordinate to the question of efficiency and labour-saving capacity.

A pot plant, supported with wire rings which fix to the stakes, is allowed to grow in a perfectly natural way. When once fitted out in the autumn it is right for the entire season. It is movable, cutting of the bloom is simpler, cuttings are taken off more easily, the plant is cleaned over in less time, and the amount of room can be increased as the plant grows.

THE TIME TO HOUSE PERPETUAL CARNATIONS

Time has changed our ideas about housing Perpetual Carnations. Few, if any, of us leave our plants out until late September to be bathed in the heavy dews of autumn. Of course, there are still points in favour of late housing, and a carnation house with insufficient ventilation is the strongest of these; in other cases by August or early September all plants should be housed away in their winter quarters.

I know how refreshing it is in the autumn to see the plants, when left out of doors, making a heavy growth with the increased dews. Too often these dews are looked upon as an assistance to the plants for winter flowering, but experience has proved that this is not so, for that it is simply an autumn growth, created by Nature to enable the plant to withstand the winter in a dormant state, and not to enable it to continue work, or, rather, grow and pay rent. If the plants are placed in an airy house in August the summer growth is continued, and the gradual acclimatizing process is begun, so that there is no undue exciting of the growth, compared to the late September housing, when the plants receive a greater change, and do not produce nearly so high a grade of flowers until the spring. In this matter, also, it is better that the buds should be formed under glass than out in the open, and that is why market growers commence to house early in August, whilst others greatly prefer to grow their entire stock under glass all the summer for early blooms, because they are of better quality, earlier, and on better stems.

Some may think that I have lost count of the hot, early days in September, but with a circulation of air and good light no ill effect will take place if the thermometer does run up high during the day.

It is unnecessary for me to point out the great importance of having the house perfectly sweet and clean before housing the plants. All should be clean under the stages, and the back walls should be limewashed. The power to decide when to take a plant up is only surpassed by the power to discriminate when to lay it down. If a plant is worth housing it is worth a clean house and sufficient room in which to breathe, not less than 6 inches between the plants is advisable. It is folly to be in such a hurry that there is no time to have the plants properly cleaned over before housing. Worms in the pots are a serious pest, and no thickness of ashes appears to keep them out. It is not that they feed on the roots, but that they completely change the texture of the soil, turning it into a heavy mass, in which the roots cannot live. The drainage is also invariably choked. The simplest remedy is to house the plants and



A commercial type of Perpetual-flowering Carnation.



Border Carnations of delicate and varied colouring.

allow them to become dry. Then get a pound of air-slaked lime, and soak it in 2 gallons of water, and after twenty-four hours water the plants with this fluid. It will not injure the carnations in the least, and will quickly get rid of the worms.

It is a mistaken idea that Perpetual Carnations require shading in the autumn. The few early blooms had much better be allowed to spoil than the plants weakened. The plants should be sprayed twice on bright days, and the houses damped down, but no moisture should be allowed to hang upon the foliage, or, indeed, in the house at all at nights. It is almost essential to feed plants when they have grown particularly well, and have outgrown their pots in August, but that they be fed very lightly after mid-September and during the winter. It is, perhaps, the best test of a fertilizer to see how it brings the plants through.

The positions of the varieties in the house should be studied. All non-fading colours, such as white, crimson, and red, should be placed where they will be freely exposed to the sun; while the delicate pinks, and all colours that fade, are best placed in the shadier positions, on the north side of the house.

GROWING PERPETUAL CARNATIONS THE SECOND YEAR

Many are undecided on what to do with the plants after the first season of flowering. Speaking purely from a cut-flower point of view, the Perpetual Carnation will produce first-grade blooms for two consecutive seasons, and nearly all our best market growers carry their stock over the second year. Of course, when grown in pots, the quality of the flower is not quite so good.

If the blooms have been cut with long stalks during the winter, so as to keep the plants reasonably short, little pruning is required. There is no gain in pruning back hard, because this will make them late in flowering. The breaks made from the very hard wood also will not produce such a high quality of flowers, while invariably the plants succumb to this harsh treatment. Plants which have been forced or improperly fed with unsuitable fertilizers are useless for growing on, and should be discarded.

Potting is the most important factor in growing plants on for the second year. This should be done as early as possible, June being the latest month for good results. A very large pot should be avoided. An advance, such as a 5-inch pot-grown plant into an 8-inch pot, is a good shift; but if a plant from a larger size pot is potted on, as much as possible of the old soil should be removed, and a 10-inch pot is the limit to pot into. The plants will not be

benefited by too much shading, but a light shade, with plenty of spraying on bright days, is best. This treatment for a week or ten days will see the plants commence to break away into a free-growing state, and they may then be stood out in the open so as to regain their health and vigour for the ensuing winter, when the same treatment as advised for the younger plants should be given.

I do not say that plants during the second season are quite as good for propagating purposes as younger plants, but if correctly grown and well cared for, they most certainly produce a tremendous crop of flowers.

SUMMER CULTIVATION UNDER GLASS

The chief advantage obtained by growing carnations under glass the entire summer through is that far better blooms are obtained from them during September, October, and November, than from those grown out of doors. It also prevents some varieties which are prone to fungoid diseases from becoming affected. The plants themselves make a cleaner growth. In some varieties the entire crop of bloom is not quite so large, whereas with others it is improved.

Under any circumstances, however, it is useless to attempt to grow young Perpetual Carnations under glass in the greenhouse throughout the summer, unless they are given an abundance of air. It is also beneficial, if not essential, to have ash benches, otherwise the plants dry out too rapidly, and become hard, also red spiders will attack them severely.

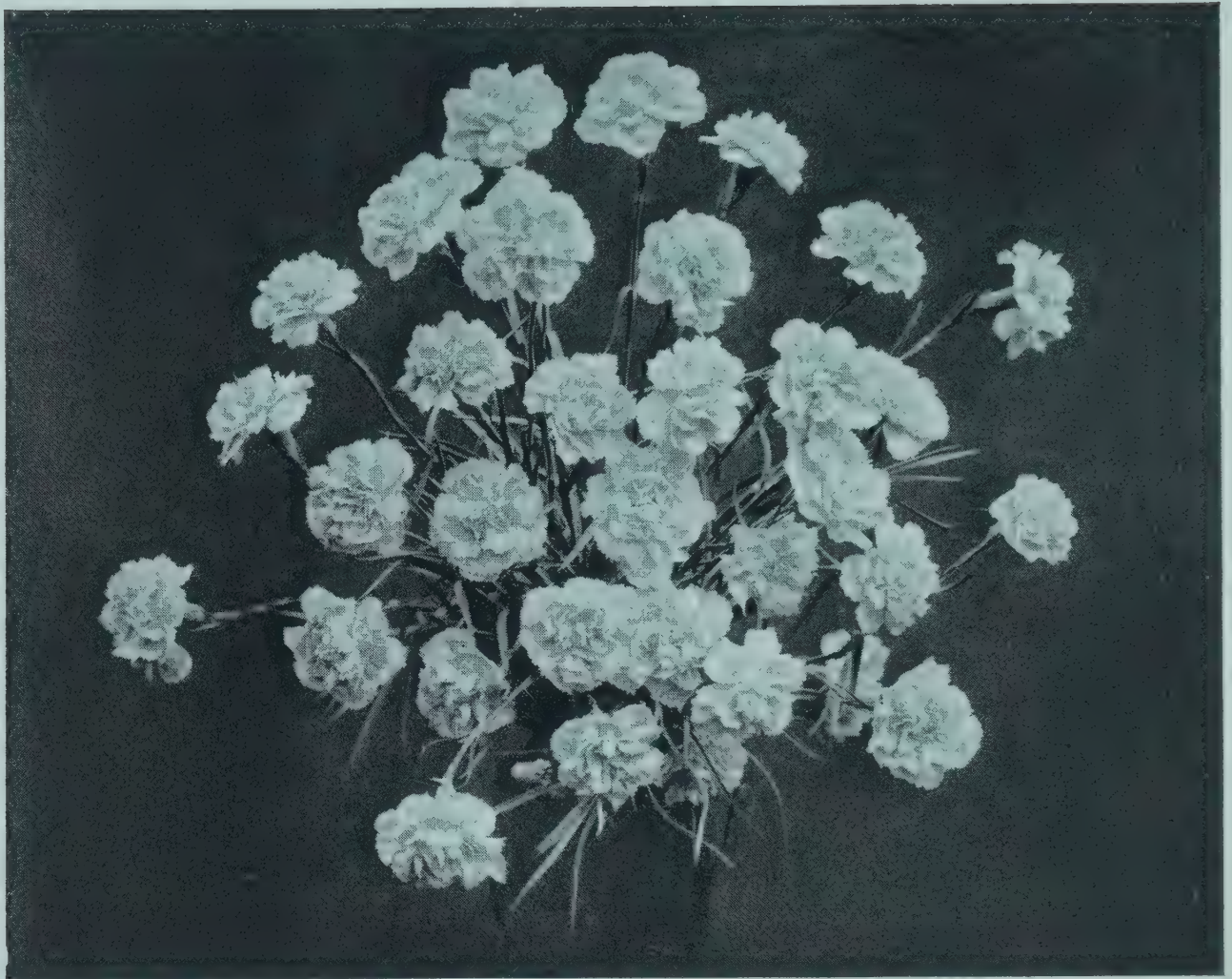
Give the plants a thorough spraying on bright days in the morning and early afternoon, thus keeping red spider, which is the greatest enemy under this system of cultivation, in check. Also make a point of keeping the atmosphere moist during bright, sunny weather, otherwise the plants have a tendency to become hard, and make a weakened growth. Some growers shade the houses when carnations are grown in them all the summer, but I have rarely found it necessary to do this with an adequate water supply and abundant ventilation.

It must be clearly understood that this system entails more labour; and frames, where the lights can be kept over the plants to shield them from cold, heavy rains, and also protect them upon cold nights, are advisable for amateurs and private gardeners.

Whatever system or method of cultivation is followed during the summer, there will be work to be done. But it should not be looked at in that light, for it is hopeless for anyone to succeed in gardening who has any distaste for work.



A Perpetual-flowering
Carnation with perfect
shell petals.



The charm of Perpetual-flowering Carnations.

CHAPTER VII

FLOWERING PLANTS OF PERPETUAL CARNATIONS IN WINTER UNDER GLASS

It is in the dull, dark days of winter that the grower of Perpetual Carnations fully appreciates the beauty of his plants blooming under glass. He forgets the dormant, sleeping vegetation outside, for it is perpetual spring with this divine flower in bloom.

In winter we expect dull days, and naturally, in the case of any winter-flowering plant, this proves to be a most trying period. Increased heat without increased light is detrimental. During these dull spells the flowers open slowly, and some varieties come a little untrue in colour, particularly those with purple in their make-up. Under such conditions, as much fresh air as the temperature will allow will keep the growth robust, and the flowers true in colour.

WATERING IN WINTER

Watering in winter requires close attention, because the fire-heat rapidly dries out the soil in the pot. Otherwise the plants would require but little water. During the winter a carnation will stand being kept fairly dry much better than when too wet, provided that the drying process does not extend to such a degree that the feeding roots of the plants are injured. An observant grower, however, can, by close observation and the application of common sense, quickly become proficient in this art. The simple rule to "water according to the weather and season of the year; if not, leave it alone" is yet another horticultural rule on the same subject. There are various conditions of moisture only learnt by close observation, but to go round giving this plant a teaspoonful and that a teaspoonful because it may be dry to-morrow is setting about the work in the wrong way.

Everything depends upon the climatic conditions and season of the year. Carnation plants, if growing vigorously and blooming profusely, require considerable water in winter, whereas, on the other hand, plants which are overpotted or potted too late, or in unsuitable

soil, and hence are suffering from a weakened root action, do not require much water. It is judging between these two extremes wherein the secret lies.

During the dull season of the year great care has, naturally, to be exercised, the selection of suitable days studied. No plant ever wanted more water simply because it was Saturday and the waterer was doing Sunday duty. To water heavily upon dull, rainy days is useless, simply because no evaporation is in progress through the leaves. All watering should be done by midday; no damping or spraying overhead should be done. Few of us realize that half the moisture absorbed by a carnation transpires through the leaves and does not actually go to build up the growth.

Towards the spring of the year, after a dull spell, the growth of the plants may become so soft that they flag on the first bright day. In the eyes of the inexperienced grower this may be taken as an indication of dryness, and a heavy watering is given before the plant requires it.

But rules for watering plants must always be elastic and adaptable, as soil conditions vary so greatly that some require far more water than others.

DISBUDDING

As far back as the historian can trace, the thinning out of some of the buds produced on the flowering growth of a carnation has been practised to assist the remaining buds to develop larger blooms, and undoubtedly the ancient gardener who discovered this method was a master of his craft. While the knowledge of this practice is so common, and the operation so simple, a strict attention to details is vitally important, or the object in view is defeated.

Disbudding, in the case of the Perpetual Carnation, is a prime necessity, because it requires almost as much effort on the part of the plant to produce three blooms on one stem as it does to produce three blooms on three separate stems. It is not the stem, but the flower, which takes the vitality out of the plant. Years ago, when the great beauty of a perfect carnation was not appreciated to the extent that it is to-day, the practice of removing the crown bud, and allowing several of the lateral buds to develop, was quite common. Many market growers used to serve their plants this way, and sent short-stemmed blooms to market. At the present time such blooms would be almost an unsaleable commodity.

Too often the novice or over-anxious gardener, in his endeavour to procure very large flowers, errs on the severe rather than on the



A Carnation house in full flower in November. Note the use of modern wire supports.



From left to right : Flowering growths
spoil through want of disbudding ;
the correct condition for disbudding ;
disbudded growth.

44

Development of the Perpetual Carna-
tion showing the improvement in habit
of growth between the old and modern
varieties.



45

lenient side in disbudding. He removes the lateral buds as soon as they become visible, injuring the main stem and leaves in his over-eagerness. To remove the buds at the base of the stem thus early would perhaps do little harm; but those at the top, close to the crown bud, should be allowed to grow to an easily handled size before removal. On the other hand, if the lateral buds are allowed to remain until they become almost fully developed, more plant tissue must be wasted, and a proportionate amount of energy also, thus defeating the object in view.

If disbudding is to be done, then, it should be treated in a systematic way, the plants being examined each week, and only those buds removed which are of sufficient size to handle. As a rule, the lateral buds towards the base of the stem are ready for removal at least a week before those near the crown bud (see Fig. 44). It is a common practice in commercial establishments in the autumn, when the Perpetual Carnation naturally makes a short stem, also to remove one or two of the stem growths. This not only gives a longer stem to the flower, but helps to keep the plant's growth short and compact.

HEAT IN WINTER

The ideal "fresh airy" conditions in a Perpetual-flowering Carnation house in winter are best promoted by having fire-heat and ventilation in the house. The exact amount of each is governed by the climatic conditions prevailing at the time, so as to maintain the required night temperature with a buoyancy in the air.

There is no sense in closing the ventilators in the early afternoon with the idea of shutting in the heat and driving the temperature very high in order to save fuel, because it will only last for a short time, after which the plants will become chilled. If there is no artificial heat, the house should always be ventilated.

Sometimes in the autumn we get mild, damp weather, when one would imagine that artificial heat was unnecessary, but with ventilation and just sufficient heat to dry up the atmosphere a little and keep the air moving has a magic effect upon the house.

While a carnation is more tolerant of cold than it is of excessive heat, there is no reason why the plants should suffer from either.

The correct temperature for carnations must be governed, to a large extent, by the strength of light, more particularly in the case of artificial heat. Air also has a powerful bearing on the subject. We all know that a carnation house can run up to 90 degrees in the summer with sun heat without any ill effect, providing there is a

circulation of air; whereas if this heat be reached by artificial means, with an equal amount of air, the plants will be materially weakened, simply because the increased heat was not counteracted by an increased light. The absolute necessity of a strong, direct light in growing Perpetual Carnations is a factor which should never be lost sight of. This fact is more fully appreciated in America than in this country.

As far as possible a carnation house with winter blooming plants should always have air upon it, and when fire-heat is in use in dull weather, this becomes most essential, in order to promote a slow circulation of air. That is why the chief carnation growers build large, light, lofty houses, so that in very severe weather a large body of air is retained, and if little or no ventilation is on the house, there still is a buoyancy in the atmosphere.

In changing from day to night temperature, we are striving to imitate Nature by adhering to the principle that light and temperature go hand in hand, and the reduction in the temperature until midnight is an attempt to follow it more closely. I am not in a position to say that this theory is ideal, nor, on the other hand, to condemn it as entirely wrong, because it will be seen by all intelligent growers that there is a certain element of merit in it. One of the fundamental principles of carnation culture is to avoid sudden fluctuation in temperature, especially a descending one, as it tends to cause splitting.

Take, for example, a bright day in January, when the sun sets about 4.30. The ventilators will require lowering, more or less according to the outside temperature, from 2 to 4 p.m., at which time, under ordinary circumstances, the ventilators would be almost closed. Meanwhile the heating apparatus should have been got into readiness to respond when called upon, because the sun's influence lessens rapidly as its rays begin to leave the glass. Increase the inside heat as the outside temperature falls, but instead of maintaining the regular day temperature, allow it to fall gradually until 45 to 50 degrees is reached. The idea of regulating the temperature is not to counteract anything which has gone before, but to give the plants the temperature in which they will produce the strongest and healthiest growth.

I believe that, under ideal conditions, the best carnations and the healthiest growths are procured by a night temperature of 50 degrees in the south and 45 degrees in the north. Too low a night temperature will cause a standstill, which is harmful. When the light becomes stronger, as the day grows longer, more heat is

CARNATIONS IN WINTER UNDER GLASS

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also wanted; that is why we have a higher day temperature, which should be regulated in proportion to the strength of the light.

I cannot see any reason why the night temperature should be lower at midnight than at, say, 8 p.m., because, as a rule, in winter the night is not darker, nor does there seem any reason why the night temperature should prevail until the outside temperature rises, because it might not rise at all.

In growing carnations there is scope for adapting oneself to circumstances and the prevailing condition of things. For instance, if the house is a light, airy structure, then a night temperature of from 45 to 50 degrees is right, with a day temperature 10 degrees higher; but if the house has heavy rafters, and is old-fashioned and ill-ventilated, or in a bad position (all of which means a poor light), then the house must be run at a lower temperature to counteract it, so we will say 40 to 45 degrees at night, with a day temperature of 50 to 55 degrees.

SPLIT CALYX IN WINTER

The two chief causes of this fault are sudden changes in the temperature and lack of sunshine. The first can be avoided by close attention to the ventilators and boilers. It sometimes happens that on cold yet occasionally bright days in mid-winter, when one is tempted to have the fires too low, the temperature drops too suddenly when the sun leaves the glass.

The second cause can be counteracted by cool treatment and ventilation, which is consistent with a strong, healthy growth. The selection of cuttings for propagating is also important. Avoid plants which split their calyx, as I believe that this is hereditary to a certain degree. The use of a too quick-acting fertilizer will also cause the calyx to split.

COLOUR OF FLOWERS IN WINTER

To obtain the best colour in the blooms is a matter of no small importance to amateur and professional alike. A strong sun will naturally bleach the colour, and shading and cutting the flower when three parts developed has to be resorted to. The pink shades, as a rule, come a little deeper in colour if grown in a cool atmosphere.

I have found that in nearly every variety of a delicate pink shade that the colour is heightened or enriched when the plant is kept slightly on the wet side, while allowing the soil to dry out

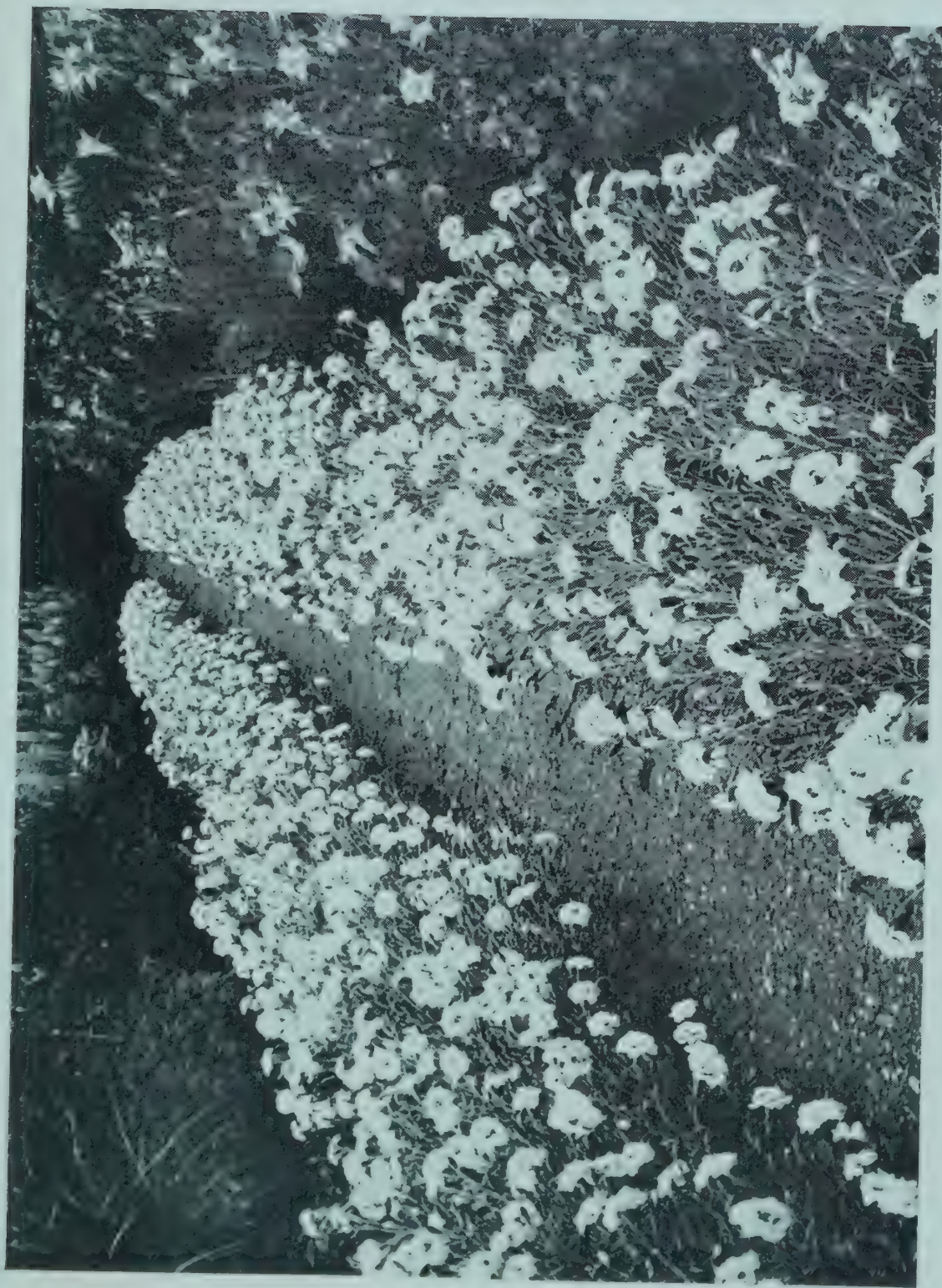
frequently causes the colour to pale. This is particularly noticeable in the case of white varieties which are inclined to have a faint pink tinge.

SHADE

Whilst light shading of the flowering stock is essential, it is very easy to shade too heavily and also too early in the year, because the plants make what might be termed "a spring growth." This is of a very rank nature, and unless the plants have strong sunlight, it becomes very soft, and devoid of the necessary tissue, in which case the plants suffer as the season advances and the sun's power increases, producing an inferior growth of bloom.

April, as a rule, is quite early enough to commence shading the flowering plants, and then it should be put on quite thinly, for there will be days when we wish that we had none at all on, while, as the season advances, the flowering plants benefit by it being a little heavier.

It has been conclusively proved by experiments carried out, both in Germany and England, that certain plants, such as roses, when grown under glass, benefit by a slight shade or reduced light in summer, and it is not until the light is reduced to about one-twelfth that they begin to suffer. This is proved by a few cloudy days in midsummer, when it is seen they will improve the appearance of the plants under glass; but this only applies to very bright summer weather.



An edging of hybrid pinks is attractive both in flower and foliage.



An amateur's model Carnation house.

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The interior of an ideal
Carnation house.

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CHAPTER VIII

CARNATIONS IN THE COLD GREENHOUSE

FOR BEDDING, ETC.

It is, to say the least, unfortunate that while so much has been written and spoken in favour of the carnation during recent years, seldom, if ever, are its many merits for cold greenhouse cultivation extolled. It can be said, without fear of contradiction, that few, if any, plants are more adaptable, providing that the simple rule of having a circulation of air in the house at all times is followed.

Under cold conditions all classes of carnations will live in neighbourly fashion together, but undoubtedly the Perpetual Border Carnations is the best section to cultivate in a cold greenhouse, for its natural tendency is to remain semi-dormant during the winter, when growth in a cold greenhouse cannot be satisfactory, while its growth is very active at all other seasons.

The Perpetual-flowering Carnation is also most excellent for the cold greenhouse, particularly so when the few rules about stopping the young plants to regulate their season of flowering are understood. For instance, for autumn flowers no stopping should be done after mid-June, which stopping should be carried on until August to defer flowering until the spring.

Border Carnations and *Allwoodii* in the cold greenhouse are dealt with in other chapters, but it will be understood that all members of the *Dianthus* family can be cultivated under this system when the method of cultivation is adapted to prevailing conditions.

THE GREENHOUSE

It will be readily recognized that in many greenhouses where Perpetual-flowering Carnations have not been flowered during the winter with success, owing to lack of light, the same greenhouse, used as a cold house for carnations, can be made to produce most excellent results, simply because in the former case you encourage winter growth, and in the latter you discourage it.

VENTILATION

This is perhaps the most important factor, because if the greenhouse is not adequately ventilated at times it will become too hot, and so force or weaken the growth of the plants; furthermore, as the autumn advances, the growth must be hardened or matured, so as to withstand the severest frosts of winter without injury—in fact, it is not frost nor excessive cold which will injure them, but a close, damp, cold atmosphere.

The ideal cold greenhouse should have ventilators on both top and sides, and have a box or other small ventilator just above the ground. The last should never be closed, and the same applies to the top ventilators, which should be partly open on the quiet side (*i.e.*, the side opposite to that on which the wind is blowing), while on hot, still days or nights all ventilators should be fully opened. It is the adjustment of ventilation between these two extremes that requires judgment and skill, which cannot be learnt from books, but only by personal observation and judgment.

WATERING

No writer can give precise guidance as to watering, because this depends upon the climatic conditions and season of the year, but no carnations should be kept excessively wet or excessively dry. When a plant is dry it should have sufficient water to saturate all the ball of soil, while the hole at the bottom of the pot will drain away all surplus moisture; but to keep the soil sweet and roots healthy it should be sufficiently dry to require water before it is given.

POTTING

There is one general rule for all carnations and *Allwoodii*—in fact, all *Dianthus*es grown in a cold greenhouse—they should be potted into a larger pot in the early spring just before they commence active growth, and in the case of all plants it is best to remove a good proportion of the old soil at the top of the ball and the crocks, also the mat of fine roots at the bottom and sides; this encourages new, vigorous young roots, while the slight check is more than compensated for.

A strong, healthy carnation should be potted into an 8- or 9-inch pot for the second year. After this it will have exhausted its strength and completed its sphere of usefulness; in fact, I always



A continuous wealth of flower throughout the summer and early autumn.



Carnations packed for a two-months voyage in a cool chamber.

consider that cuttings are more vigorous when taken from plants the first year than the second, and, as a rule, they produce the finest flowers during the first year, although certain varieties are more productive in their second season.

THE PERPETUAL-FLOWERING CARNATION AS A BEDDING PLANT

The Perpetual-flowering Carnation can be planted in May, thus allowing time for early spring bedding or bulbs. A still greater advantage is that almost from the moment it is planted until the first frosts of winter it is one constant mass of flowers and buds, so that if one batch of flowers is dashed by the rain or spoilt by other elements, the next bright day sees them replaced by other and fresher flowers.

There are several sizes of plants suitable for the purpose of summer bedding. The cheapest grade is that in 3-inch pots, which has been propagated early, say in December, and received one stop, having from four to six good growths, some 3 inches long, at the time of planting. Such plants would commence to flower the latter part of June, and continue to do so until winter frosts arrive.

The best class of plant for summer flowering, and the one which I recommend, is that from 5- or 6-inch pots, which has been propagated late in the previous spring, and grown gently on until it is a shapely bushy stock, with growths for flower in the spring. These plants, if carefully grown, will produce by far the best results, firm planting being most essential.

Again, stock which has produced an autumn or early winter crop of bloom, if carefully handled, will give good results. The advantage of this one-year-old stock is that it commences to flower as soon as planted, continuing to produce masses of bloom all the summer; but as the plants are rather old, they have a somewhat leggy appearance.

I have seen beds where large two-year-old plants have been used, and the beds finished off with young, fresh growing plants to hide the nakedness of the old ones. Such beds, if watered during dry spells, give a very imposing effect, and are a blaze of colour throughout the summer.

SUMMER BEDDING

I feel it is outside my province to suggest suitable combinations for carnations in summer, because this is more a matter of taste, and many delightful combinations will suggest themselves to an

imaginative mind. I prefer them alone, although I have seen delightful beds of carnations carpeted with Violas; the plants in those beds were set fairly wide apart.

The Perpetual Carnation is not an exacting plant in the summer in the matter of soil, but it must have an open situation and a good direct light, and, to be productive of good results, it must not be allowed to become parched for want of water. Occasional top-dressings of a suitable carnation food or liquid feeding have a magical effect. In dry weather, plants growing in beds should be hoed weekly, or mulched, if alone, but if carpeted with Violas, Lobelias, or other plants, this is not necessary. It must be understood that Perpetual-flowering Carnations, generally speaking, are not hardy, and so rarely survive a severe winter out of doors.

THE CARNATION IN EVERY CLIMATE

There are few, if any, climates where some race of the *Dianthus* family will not flourish, although until the advent of the Perpetual-flowering races it was impossible to cultivate carnations in countries where there was no winter or dormant period. In such cases the old types of Border Carnations and Malmaisons rapidly exhausted themselves, and became useless through lack of rest. Now it is difficult to find a country where Perpetual Carnations and *Dianthus Allwoodii* will not flourish. It is well known that South Africa, Australia, and New Zealand produce magnificent carnations, and even China, Brazil, Japan, and parts of India obtain good results, though, of course, Europe is the home of the carnation.

I do not propose to be so foolish as to try to tell growers abroad how to grow carnations, because climatic conditions and cultivation call for local experience; however, I do believe that the study of methods employed over here will enable them to make their own deductions.

The carnation is a reasonable plant, and will quickly adapt itself to conditions, particularly in the case of those grown from seed. Imported stock should, as a rule, be used for propagation purposes, for the home-propagated stock grows away better.

Stocks of new and improved kinds can only be imported as young plants; no reliability as to colour or other qualities can be fixed in seed. Young plants are best shipped to any point over a fortnight's journey in a cool chamber in or ex 2-inch pots packed as Fig. 50. These should arrive at their destination either during the autumn, winter, or very early spring.

TREATMENT FOR CARNATIONS WHEN LANDED

Carnations, when landed, can easily be killed by being subjected to a severe change; for instance, they cannot withstand a very powerful sun, and a very strong air is also detrimental, so that they should be stood in partial shade, and protected from full air pressure.

The root action is naturally in a very weakened state, so it is not wise to pot them into large pots, or plant them in very rich soil.

Watering must be done with discretion, so as to tempt the roots into a healthy active growth, and carefully harden them up to normal conditions. Any dead or decayed leaves should be carefully removed, and the plants must not be potted or planted deeper than they stand in the original soil. I always advise propagating a certain number of cuttings as soon as possible.

The preparation and packing of carnation plants to travel to the uttermost parts of the world is quite a simple matter for those who understand it. The plants must be of a strong, healthy stock, and packed in cases with a circulation of air amongst them. There must be no excess of moisture, or it will cause decay, while it must be remembered that if moss is placed round the ball of the plant, none must touch the stem itself.

TREATMENT OF CARNATION PLANTS ON VOYAGE

It is always advisable to have the plants stored in the vegetable chamber, and not in the hold or in a cabin.

The danger in shipping carnations over long distances when they are packed in cases is that they are liable to decay at the stem through lack of air and light. Carnations can withstand excessive drought better than excessive moisture, and, as a general rule, do not require watering with fresh water more than once a fortnight, although this generally depends upon the climatic conditions through which they are passing.

CHAPTER IX

SOUVENIR DE LA MALMAISON

(These must not be confounded with Perpetual Malmaisons, see p. 63.)

THERE is some diversity of opinion regarding a correct definition of a true Malmaison, yet it is generally accepted that a typical flower is one which reproduces itself from the centre—*i.e.*, has a very large double centre composed of small petals. On the other hand, in a batch of seedling carnations, one may obtain many plants and flowers resembling a Malmaison, and yet have but a poor, weak habit of growth, coupled with a weak stem; these are debarred from bearing the name. It is most essential that the habit should be very stiff and strong, and the foliage broad, also that the flowers should be large and massive in appearance.

Although the Malmaison originated in France, it remained for England to perfect its cultivation, and develop the flower; in fact, to-day in France the Malmaison is but little cultivated. This may be owing to the fact that the Continental Perpetual Carnation more closely resembles it in build of flower; also that the climate and conditions of soil in England, the land of its adoption, are more suited to its requirements.

Propagation must be done by layering in the summer (see Chapter X). Layers should be potted up in time, so as to receive their second potting and become well established before the winter months. Propagating by cuttings can be done as advised for propagating Perpetual Carnations. To propagate any carnation by cuttings, however, is to weaken it. This fact can be tested by Malmaisons themselves, and is proved in the case of Perpetual Carnations, the varieties of which only last for a limited number of years, and yet the old Malmaison which is invariably propagated by layering will apparently, like Tennyson's brook, go on for ever. During the dull season allow the plants to rest: cool, dry, airy conditions are the most favourable to the plant during this period, and undoubtedly it is in the winter treatment wherein lies the secret of Malmaison culture. Excellent results are obtained from plants wintered in



A house of Perpetual-flowering
Malmaisons in flower in April.



A two-year-old plant of a
Souvenir de la Malmaison.

frames, with just sufficient heat to dry the air. This, with little water and much ventilating, gives the necessary conditions. But what a contrast to the spring season, when the Malmaison rushes away into a vigorous, robust growth, and calls for much food and water. Then the air should also be charged with a certain amount of moisture. The Malmaison must be shaded from the strongest sun during the late spring and early summer, or the blooms will suffer in size and colour. But let this be the golden rule in Malmaison growing—never have all the ventilators completely closed.

POTTING OFF THE ROOTED LAYERS

Aim at having layers potted before the end of August, and use a 3-inch pot. Many growers use 4-inch pots, but I find that the layers establish themselves in the smaller size more readily. The best compost to use for potting the layers and for second potting, also the methods of lifting, potting, etc., are similar to those advised for Border Carnations; furthermore, like the Border Carnation, no stopping must be done (see Chapter X.).

AUTUMN CULTIVATION

Each grower has his own particular idea of treating a Malmaison during the autumn months. Some stand the young plants in the open, leaving them to the mercy of the gods, who are often at this particular season anything but merciful to them. Heavy, cold rains will do irretrievable damage to them; and while heavy autumn dews will do Border Carnations an amazing amount of good, they will have the reverse effect upon Malmaisons, stimulating and aggravating any disease which may be lurking in the system of the stock, and, I hold, even creating it in many cases with a perfectly healthy stock. While I am ready to admit that the object should be to have hardy plants, this end is not gained by impeding a natural autumn growth by standing them in the open. If the plants are stood in a light, airy cold frame, or, still better, in a light, airy cold greenhouse, with an abundance of ventilation, they are then under control. See that everything is perfectly sweet and clean around them, allowing a liberal amount of room between the pots. Keep them well supplied with water, as the roots at this particular season are most active. Give a very light sprinkling overhead only on excessively hot days. Even then, during the early morning, promote a moist, fresh, airy atmosphere, while the plants are in a vigorous growing condition in the early autumn.

The amount of air to give the plants at night from the end of September onwards is a matter to be decided individually, taking into consideration the latitude and the time of the year. The question is not how little, but how much can be left on at night. Under ordinary circumstances, during any season, a little air should be afforded to cause a circulation.

POTTING ON INTO 5-INCH POTS

This is a main factor, and should be done as early in the autumn as possible. The cardinal point in growing Malmaisons during the first year is to obtain as large a flower in as small a pot as is reasonable. While a fair-sized flower can be obtained from a 5-inch pot, a still better can be cut from a plant in a pot 2 inches larger, but bigger pots than these for the first year are unwise and unnecessary. If the layer is potted into a 3-inch pot in the first place during August, it will require a move on into a 5-inch pot in late September or October, using the same compost. Some growers of Malmaisons use leaf-mould and even peat, but I do not favour this practice, and advocate the use of old yard manure instead. Pot your Malmaisons a little firmer than you do your Perpetual Carnations.

If the plants are growing in a cool frame, it will be found advisable to stand each plant upon an inverted pot. Plants which have not made sufficient progress to be fit for potting during the autumn will be found to be semi-dormant layers, which rarely make creditable plants, and never desirable stock. Potting after October is not to be advised.

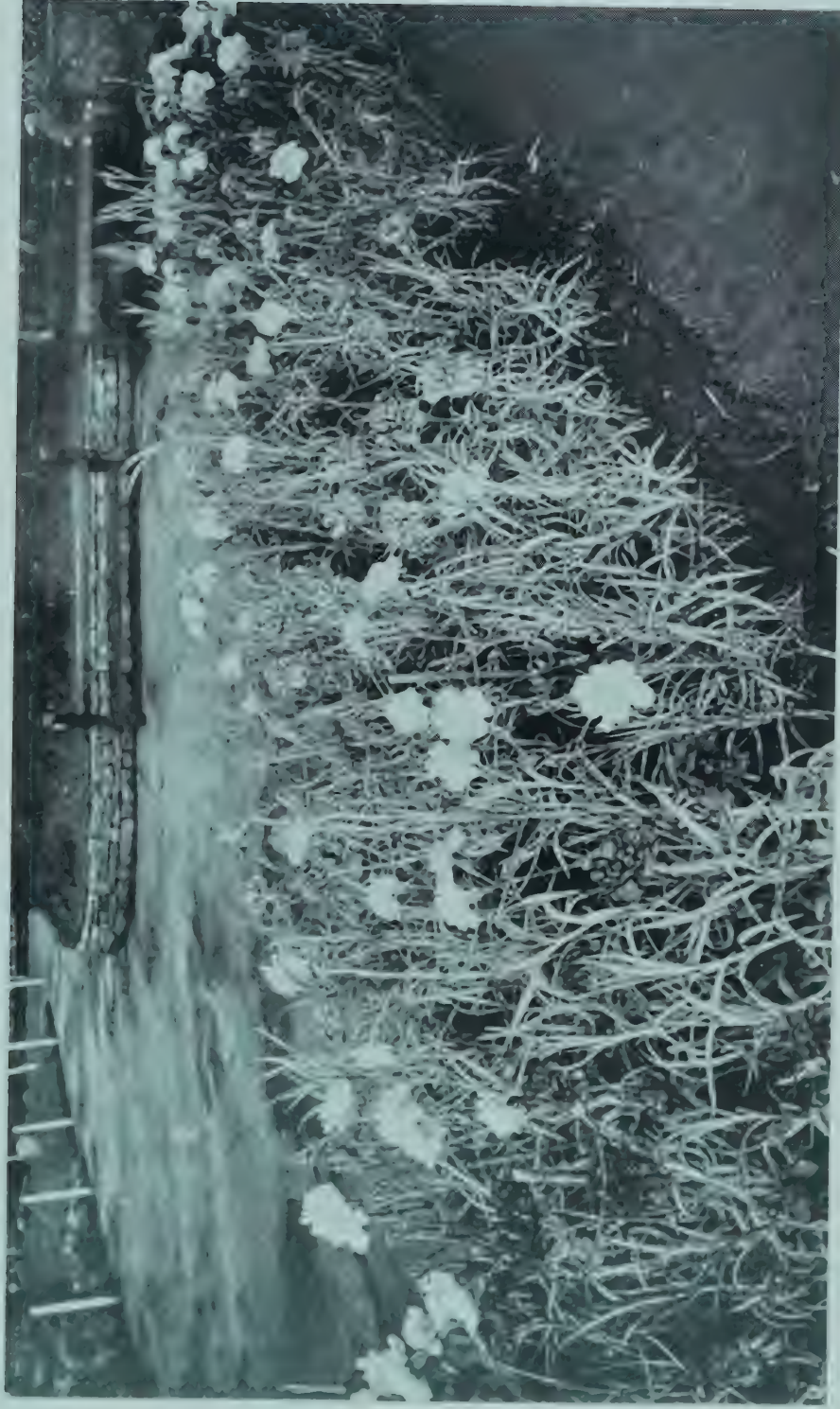
Watering will call for minute attention, as the plants commence to enter into their dormant state during late autumn, and the amount of water must be considerably reduced.

Malmaisons will grow alongside pot-grown Border Carnations in a cold greenhouse. To attempt to grow them along with Perpetual-flowering Carnations for other purposes than to force the plants into flower is only courting failure. For treatment during the winter, see Chapter VIII. on the Cold Greenhouse.

SPRING CULTIVATION OF MALMAISONS

No cultivator hails spring with greater joy than the Malmaison grower, and no plant that I know responds so readily to its call.

Commence potting in early January from the 5-inch into 7-inch pots, just catching the plants when they require an increased amount of root room and renew vigorous growth, so that they can benefit



A bed of Carnations in a well-drained sunny situation.



Perpetual-flowering Malmaisons are distinct in growth from the Souvenir de la Malmaison.

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Souvenir de la Malmaison has various types of growth.

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by the fresh supply of food at their re-awakening into more active life.

Make a practice of not watering in your plants for three days after potting at this season of the year, for if the plant was in a right state of moisture when potted it would not require it. Watering will have to be done with great judgment for a time, until the plant becomes established, but under-watering is as great a fault as over-watering. When the plant is well supplied with roots an abundance of water will be required, or it will receive a check.

Towards April the Malmaison is at the height of its vigour. Weak feeding can be given, as the plants commence to run up for bloom, but under no pretext must this be given unless the soil within the pot is full of roots and the plants are in a robust condition; a little night air, avoiding draughts, should be continued, but upon warm, bright, genial days and warm nights throw the house entirely open.

Those who have grown their Malmaisons in cold frames during the winter can bring them into a greenhouse in March.

It is the rule to shade Malmaisons as soon as the buds commence to burst and show colour, otherwise the sun will bleach many of the colours. Wood roller blinds are best, but tiffany or canvas blinds are also good. Failing these, a coating of light summer shading will answer the purpose, taking precautions not to syringe it on too thickly, or the plants will suffer in dull weather.

It is best to stake and tie the plants. This should be done in early spring. An 18-inch or 2-foot bamboo cane will answer in the case of most varieties.

As the buds are formed, it will be found beneficial for them if the paths, etc., of the house are damped down on bright days. Aphis and all insect pests must be exterminated previous to the plants flowering.

The majority of growers disbud Malmaisons to the crown flower. This is purely a matter of choice and requirements. Under any circumstances, the buds must be thinned out to four, the lower lateral buds being the best to leave. It is an excellent practice, in the case of plants grown for flower and stock purposes, to thin out the layers to four or five in the early growing season, thus throwing more strength into the flower and the remaining layers.

GROWING SPECIMEN MALMAISONS

This plant, above all others, is undoubtedly the one upon which a skilled cultivator may exercise his talent. There is no plant that will reward him so lavishly for his labour, both in the size of

flowers and plant. He who can grow an individual Malmaison for four or five years, and have a perfectly healthy plant, with from fifty to a hundred flowers and buds, can calculate that he has thoroughly mastered this difficult subject. To grow a specimen Malmaison one must be a skilled cultivator.

TWO- AND THREE-YEAR-OLD PLANTS

Plants grown on for the second and third year will require identically the same treatment, in the form of watering and ventilation, etc., as the one-year-old plant. Personally, I am firmly of the opinion that where a greenhouse or cool frame is obtainable these plants do much better when grown entirely under glass, and not stood out of doors after blooming during the summer, as is so often practised. When the plants are under glass the watering, which is so important a factor, is entirely under control, disease and insect pests also are much more easily dealt with.

As soon as the one-year-old plants have flowered, cut out the flower stems, and put each plant into a pot a size larger, using the same compost as recommended for the final potting. A point of importance is that they should not be starved in the flowering pot, but be encouraged to make a good growth for the following season. Always remove some of the old soil when potting on.

The Malmaison is kept in better health when grown on for a number of years in a less rich soil. Stake and tie each growth separately, giving the plant a shapely appearance.

If the plants make such encouraging growth that a second potting in the year is deemed advisable, this is best done during the following February and not in the autumn, but I find that rarely, if ever, is this necessary.

MALMAISONS FOR WINTER FLOWERING

The natural time of flowering for the *Souvenir de la Malmaison* is from April to August, according to the variety; and, while it is possible to persuade it to bloom during any time of the year, it is naturally a risky and difficult process, and is not practised by any grower without great loss and uncertainty—in fact, in these days of mammoth Perpetual-flowering Carnations, and Perpetual Malmaisons it is wholly inadvisable and unnecessary.

THE PERPETUAL-FLOWERING MALMAISON

IN the Perpetual-flowering Malmaison we have a new class of plant. It is one with an exceptionally bright future, mainly because Malmaisons have for a long time been great favourites. This plant will even excel its forerunner in popularity, because it produces a flower distinct in its massive beauty from the carnation, and one which will be supplied in small quantities all the year round. I believe its progress and development will be very slow, owing to the uncertainty of seed raising for new varieties, but what matter if the flowers are choice and beautiful?

PROPAGATION BY CUTTINGS

The Perpetual Malmaison should be cultivated in every detail more like the Perpetual-flowering Carnation than the old Souvenir de la Malmaison, hence propagation by means of cuttings is the main method of increasing the stock. This should be done precisely as advised in Chapter II. I have found, however, that the selection of only the best and strongest cuttings plays, if possible, an even more important part than in the cultivation of the carnation. Too early propagation is also detrimental, because such heavy, thick growth must be kept growing. December is quite early enough to propagate Perpetual Malmaisons, and only heel cuttings must be used.

PROPAGATION BY LAYERING

Layering is the other means of propagation advised for this plant. This method has many reasons to recommend it, the principal of which is that, owing to the thick, heavy growth, it is only reasonable to suppose that deterioration of the varieties will, in the case of the Perpetual Malmaison, be more rapid than in the case of the carnations. The strongest cuttings will not root readily, in spite of the fact that they are the best; and under any circumstances they must be weakened in the operation more than cuttings of carnations. That is why I say that propagation by means of layering is to be advised, because, as is pointed out in the earlier chapters, this adds to, rather than detracts from, the vigour of the young plant.

This method should be carried out as early as possible. I prefer March for layering in the greenhouse, and June for layering in

frames. It is done in the same way as for Malmaisons and Border Carnations, except that it is advisable to layer the short, young growths produced more at the top of the plant. Make a practice of growing all Perpetual Malmaisons on for two years.

YOUNG PLANTS

Grow your young plants with the young Perpetual Carnations, and treat in the same manner, except that you must always give them the best situation. I find that they benefit by being potted slightly firmer. It is absolutely fatal to allow a Perpetual Malmaison to become potbound.

Make a point of having your plants established in the 5-inch pots before stopping them at the sixth joint. No Perpetual Malmaison should be stopped before March, because the breaks will not be nearly so numerous nor so strong.

The system of stopping in the case of the Perpetual Malmaison is to keep the plants growing strongly and vigorously until they are about 6 inches high, when you stop them; then allow them to run direct off to flower. If this is done in March, September is the earliest month in which they will commence to flower, when a succession of flowers will be produced. This practice will yield better results than stopping any of the plants twice, as advocated in the case of Perpetual-flowering Carnations.

SUMMER CULTIVATION

The Perpetual Malmaison produces the best results during the ensuing winter if cultivated entirely under glass throughout the year. It is not essential that it should be in a greenhouse; in fact, a well-situated frame is to be preferred, as under such treatment the plant receives good light and air. They must, however, be removed to the greenhouse in early September, or the autumn dews will develop disease and cause bad growth. Support your plants with the Patent Wire Plant Support in June. The same rules laid down regarding Perpetual-flowering Carnations also apply to this section.

WINTER CULTIVATION

At this season of the year the work is almost precisely the same as that advised for Perpetual-flowering Carnations, and there is little to add to what has been previously written, except that the Perpetual Malmaison prefers the lower rather than the higher scale of temperature advised for Perpetual-flowering Carnations.



A perfect Perpetual-flowering Malmaison.



Modern Border Carnations
are varied in their colouring.

CHAPTER X

BORDER CARNATIONS

THIS, as is generally known, is the old original race of carnations, and has been cultivated in our gardens for centuries, so that few of our present-day gardens do not possess some specimens of it.

It is a distinct race of carnations which bloom once during each summer; the flowers are perfect in form—in fact, few plants are so highly developed. They are grouped purely for exhibition purposes under various classifications such as Picotees, Flakes, Bizarres, Fancies, Yellow Grounds, Selfs, etc. Certain varieties have been developed more for exhibition purposes than for garden decoration, and have a weak constitution, which is a great mistake, because a Border Carnation should be a hardy, easily-grown plant.

POSITION TO GROW

The cultivation is very simple, providing two essentials are observed. The plants must have a direct light and not be overshadowed by trees, also the soil in which they are to grow must not be sour through lack of drainage or bad cultivation; in the latter case, drainage should be made by trenching and by raising the beds, while the soil is best sweetened by dusting it with pulverized limestone, before and after digging. Situations and positions are dealt with in Chapter XI.

WHEN TO PLANT

For almost a generation it has been a debatable point which is the best season of the year to plant the young stock out of doors. I have no hesitation in saying that in suitable well-drained soil, and in the case of hardy varieties, autumn planting is to be preferred. In the case of spring planting, March and April are the best months; planting later than this is rarely a complete success in the case of Border Carnations.

HOW TO PLANT

Never plant the young stock deeply, but only sufficiently so to hold it firm in the ground; 9 inches between the plants is the minimum distance to plant, while 15 inches is not too much space to allow between strong, vigorous young plants. Those intended to be left in the same position for two or more years should be planted 18 inches apart. In all cases firm planting is most essential.

ATTENDING DURING WINTER

During the winter a Border Carnation planted out of doors should not be protected by mounds of soil or mulching with litter, as it causes the lower leaves to decay; these are best left exposed to the wind and air, so as to keep the foliage dry and hardy. Hard frosts have a tendency to loosen the young plants in the soil, so that they should have it firmed around their roots after a severe cold. In an exposed position it is a good plan to tie each layer after planting to a little stake; this prevents the plant from being swayed about by the heavy winds.

ATTENTION DURING SPRING

The Border Carnation is one of the first plants to herald the advent of spring; full advantage should be taken of this. On the first dry spell the soil should be lightly hoed, so as to break the crust caused by the winter rains, as this excludes the air; also a light dressing of carnation food should be sprinkled on the surface of the soil to be washed in by the next shower; this process should be followed each fourth week. It is impossible to hoe the surface of the soil too often during the growing season, and the one danger of which to beware is the injury of the roots by hoeing too deeply.

In March a 2- or 2½-foot cane should be placed at each plant and tied just above the surface of the soil, and as the main growth elongates for flower, it should be secured to the stake with a wire-ring tie, for there is considerable danger of the tender young growth being broken by the wind. Ring-ties are much better than tying with raffia or string, because they hold the growth loosely and are carried up the canes as the plant grows.

ATTENTION DURING SUMMER

To obtain the best blooms disbudding is necessary; the common practice is to remove the side buds round the centre crown bud, which is the best individual bloom, but the lower side buds, if left, develop into good flowers and open later.

The side growth or layers produced at the lower part of the plant grow rapidly during the late spring and early summer, and in the case of some varieties it is necessary to support these with plant supports, so as to protect them against strong winds. This is particularly necessary in the case of plants to be grown for the second year without layering.

It must be borne in mind that Border Carnations must not have their growths stopped, as in the case of Perpetual Carnations, otherwise they will not flower during the succeeding year.

LAYERING

This art is such common knowledge that one feels one is boring the reader by describing it, and yet ideally rooted layers are by no means common. The best time for layering is July, or as early as possible after the plants have finished flowering. See that there is no trace of aphid, red spider, or any other pest or disease upon them previous to layering, as it is almost impossible to destroy disease when the layers are down.

For the layers to root well, they should not be in a hard, starved condition. Remove all the leaves off the growth except that portion of the layer which will remain above the soil. At all times it is most essential to have a short layer to commence with—say, one with six fully developed leaves in the case of most varieties. Use soil as advised in Chapter III. for first potting, or clean road grit (seeing that it is free from petrol or any disinfectant)—that from a flint road is best, but any light, sandy compost will suffice. Loosen the soil round the base of the plant and place the light soil or grit from 1 to 2 inches thick upon the surface. Have a sharp knife—one with a good point is best—and commence to cut the tongue two joints below where the leaves were trimmed off, allowing the knife to split the stem for $\frac{1}{2}$ inch or so, or this can be reversed by thrusting the point of the knife through the layer and cutting downwards to make the tongue and trimming off the cut directly under the joint; then fasten down with an ordinary layering pin, taking care that the tongue is not bruised or broken while pushing it

into the grit. In the event of hot weather, water in every dozen layers or so, to prevent the cut being dried, otherwise the emission of roots will be impeded.

A layer takes from three weeks to a month to root. As soon as this function has taken place, it is very beneficial to the layers to sever them from the parent plant three days or so previous to potting them up. This operation should not be postponed. It is far better for the layer, when it has become moderately rooted, to be potted off into a 3-inch pot or replanted than for it to be left until it has so large a ball of root that it has to be put into a 5-inch pot, encouraging a soft, quick growth, which is just what is not wanted.

Other methods of layering are: to root the layers in sandy soil, placed on the top of the flowering pot, or to layer into a small pot, so that when rooted it simply has to be severed from its parent—this is an excellent method for small growers and amateurs, and answers well if care is taken not to allow the soil in the small pot to become dry. Some growers tie damp moss round the layer, and root it so, but this method demands more syringing to keep the moss damp than is good for the plant's health; while yet another method is to sink the pot in the ground, placing a light, sandy compost around the layer. The best method is the one which will enable the layer to root with the least check.

POTTING OFF THE ROOTED LAYERS

The best compost for potting the layers is as recommended in Chapter III. for second potting. This assists a sturdy growth.

When lifting the layers cut them off under the joint, and pot or plant them moderately firm and just as deep as they were in the soil before lifting. Place them in a frame or house where they can be kept somewhat close for two or three days, and shaded from the hot sun. A spray overhead during the hottest part of the day is very beneficial so long as all moisture is dried up before night. As soon as the layers are established, full sun and air, night and day, should be taken advantage of, so as to build up a perfectly healthy, robust plant, which no insect or disease can assail. On the other hand, a well-rooted layer, in the case of a Border Carnation, if planted direct out of doors in the autumn, rarely takes any harm and grows away freely.

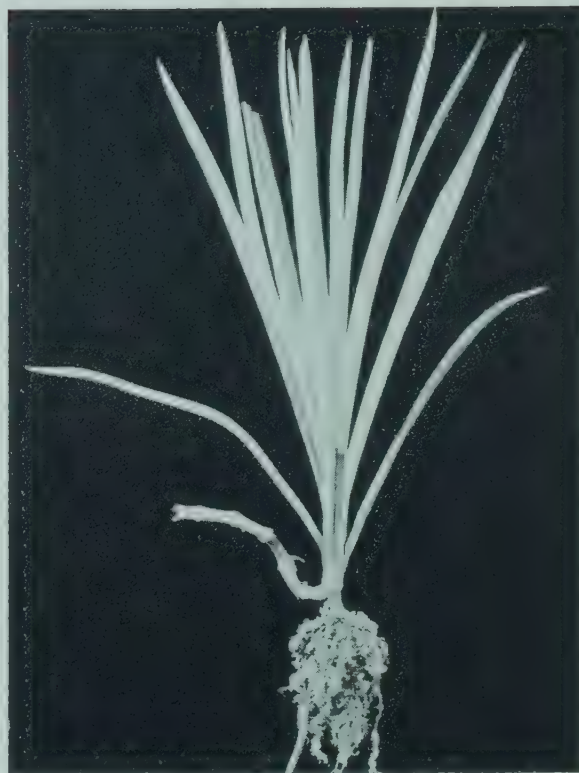


A raised bank is an ideal position
for Perpetual Border Carnations.



A perfect layer of a Border Carnation obtained from healthy stock.

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A weak useless layer obtained from worn-out stock.

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Lifting rooted layers of Border Carnations.

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OLD PLANTS OF BORDER CARNATIONS

It is quite a mistaken idea that Border Carnations must be layered each year. Plants may be left for two or three years, providing that they are growing in a well-drained situation.

GROWING BORDER CARNATIONS IN POTS IN GREENHOUSE

I feel it is unnecessary to repeat much that is written in other chapters which equally applies to this heading. If the reader studies Chapter IX. on *Souvenir de la Malmaison*, and Chapter VIII. on the Cold Greenhouse, all the information that is necessary is supplied.

As a rule, the young plants are wintered in 3-inch pots and potted on into 6-inch pots, or two into an 8-inch pot, in February. Heat is not required, and only shading to preserve the colour and prolong the life of the bloom. Of course, Border Carnations can be grown in cold frames until March, and then brought into a cold greenhouse for flowering.

CHAPTER XI

HARDY PERPETUAL BORDER CARNATIONS AND HYBRID DIANTHUS

IN the case of a plant so easy to cultivate out of doors, details of culture are superfluous, for I believe that there are few, if any, gardens where they cannot be grown with success, but the gardener with no imagination or determination will imagine difficulties and obstacles.

These are no exception to other flowering plants, and must have a direct light to produce satisfactory results—that is, plants will not succeed well under a large spreading tree, or behind a north wall, but any other situation suits them admirably.

GROWING THE YOUNG PLANTS

We have seen in the previous chapter how to propagate, which can be carried out with these two subjects at any period from April to September, in cold frames, or at any other time in mildly heated greenhouses. Summer propagation, however, is the best. Cuttings or layers rooted in early summer, and planted in the garden in July or August, would naturally commence to flower during late autumn, but this should be prevented by pinching off the tops of the plants at the sixth pair of leaves from the surface of the soil until the winter commences, when the growth stops and the plants lay dormant. It is a good plan when planting young carnations out of doors in the autumn to tie them to a short 8-inch stick, to prevent the wind blowing them about.

In the South of England the plants commence to flower in early spring, but in the Midlands and the North it will be June before the first flowers are produced. They will flower perpetually until the severe frosts of winter commence, and I have repeatedly gathered the last carnation of summer in December.

From the foregoing it will be seen that the young plants can be planted in their flowering quarters at practically any season of the year; in fact, after a cutting is well rooted and hardened to withstand

strong sun and keen winds, I consider it best to plant it direct into the garden in preference to potting it, and the same applies to rooted layers.

TREATMENT

The general treatment of the plants is practically the same as that given to other outdoor hardy plants, and the ground should be treated as advised in Chapter X. All carnations must have soil that is well cultivated and kept free from weeds; in dry weather hoeing the soil so as to keep the surface loose is important, for this acts as a mulch, thus preventing the soil from drying. It also keeps the roots cool in very hot weather, and a greater quantity of finer flowers results. Watering the plants is not necessary, except in the case of freshly planted stock in dry hot weather.

For details of cultivation and planting in the garden, see Chapter X. on Border Carnations.

DISBUDDING AND CUTTING BLOOM

Disbudding is not necessary with hybrid dianthus, but some varieties are improved by having some of the buds at the top of the spray removed; the semi-double-flowered varieties are best left undisbudded. For cut flowers, grown for market sales, remove the top crown bud, so that the lateral buds form a spray.

I strongly advise the flowers being cut with long stems. This is most essential in the case of all Hardy Perpetual Carnations, because it keeps the plants short and bushy. This is much better for the plants, also the flowers themselves display their natural beauty. If the sprays of bloom are cut with a number of buds yet to develop, these open in water, and last for a month under careful attention in a cool room.

WINTER

During the winter practically no attention is required, except that great care should be taken that with severe frosts the young plants are not lifted out of the ground, particularly those planted in the autumn in light soils; these should have the ground firmed round the roots. On no account must the plants be mulched with yard manure. This encourages surplus moisture around the collar of the plants, and will cause them to rot off, while if allowed to grow unprotected they will come to no harm.

AUTUMN

Plants which have been growing and flowering freely during the summer should have any long growths or old flower stems cut hard back, otherwise the habit and shape of the plant is spoilt. I have found that autumn pruning is best done in September. It is not wise to cut back every growth, but only the longest, so that the plants look a bushy tuft, and from such a plant the best results are obtained the following spring.

FORCING ALLWOODII FOR EARLY BLOOM

One of the most popular ways of growing hybrid dianthus is to force the plants for early bloom in April and May. The best way to do this is to grow a few plants for the purpose, keep all buds and flowers removed from the plants during the summer, lift the plants from the garden in September, only removing the loose soil, and pot them into 6-inch pots, using compost similar to that advised for final potting in Chapter III. The plants should be given a light spray overhead once or twice upon bright days, and stood in the open, or they can be stood in a frame with an abundance of air, and shaded from the strongest sun for a few days until they become established, but the system of not shading them is perhaps the best. The plants should be grown perfectly hardy until October, when they are best placed in a light, well-ventilated cold frame to shield them from the heavy rains; or good results are obtained if the plants are left out of doors during the winter; in fact, this is preferable to placing the plants during the winter in a heated greenhouse. In January some of the plants can be put into a greenhouse, not exceeding 45 degrees at night, with good light and abundant ventilation during the day. Different batches can be brought in each month, so that a succession of bloom is maintained.

Another method is to lift the plants from the garden in February, pot them, and place them in the greenhouse, but this method does not produce such good results.

PERPETUAL BORDER AND DIANTHUS FOR LATE FLOWERING

If some plants are grown during the summer and all the buds are removed until late July, such plants will continue to supply quantities of bloom during the autumn and early winter. They are covered with frame lights in late September, and given an abundance of ventilation on all favourable occasions.

A good plan is to lift and pot the plants in July, treating them as directed for forcing. If the plants are then placed in a greenhouse in mid-September, they will produce excellent blooms during winter and spring.

THE COLD GREENHOUSE

Some who have cold greenhouses have obtained wonderful results by growing Perpetual Border and *Dianthus Allwoodii* in pots, precisely the same way as you would the Perpetual-flowering Carnation; the plants continue to bloom nine months out of the twelve. This method of cultivation, I think, will become more popular as it becomes known, particularly in and near towns.

IN WINDOW BOXES

Many have obtained most satisfactory results from summer propagation stock grown out of doors in pots, placed in winter in a cold, well-ventilated frame, and planted into window boxes in March or April. Good results are obtained from young plants planted in the spring. If preferred, the early buds can be picked off and the plants potted into larger pots in early March, and planted in the window boxes in May or when required.

Good results are also obtained by lifting plants from the garden in March, and planting them in window boxes, or if the buds and flowers are picked off the plants a few weeks previous to disturbing them, they can be lifted and potted or planted in window boxes at any period during the spring and summer, and such plants will recommence to flower about a month after being disturbed.

IN DRY WALLS AND ROCKERIES

One of the greatest charms of *Dianthus Allwoodii* and other hybrid Pinks, and particularly varieties that are low growing, is the easy way in which they can be successfully grown in dry walls and rockeries. The beautiful effect obtained by growing them in this way is one of the greatest advantages of the plant; also they are superior to many other rock plants, for they flower perpetually.

So far as the hybrid dianthus is concerned, nothing can be more simple, but the plants must receive careful watering and attention when newly planted, which is done with the best success in the autumn or very early spring before the hot weather commences. Care should be taken to see that the plants have sufficient soil in the

first place to establish themselves, and that the pocket or recess has adequate drainage, otherwise the plant will become water-logged during the winter. Hardy carnations are not out of place in rockeries, and, as a rule, grow best when planted amongst stones.

IN BASKETS

The simplest way to grow plants in baskets is to line the basket with moss, and afterwards fill it with soil of ordinary compost. Then plant, selecting trailing varieties for the outside, and compact growing kinds for the centre. I have always found it best to plant baskets in March, afterwards standing them in a cold frame to become established, then they can be hung in practically any position, that with a good light being preferred.

The two essentials are that the plants must never become dry, and once a week should be thoroughly soaked, also they should be fed with an approved carnation food.

IN THE HERBACEOUS BORDER

Many ways to grow these adaptable plants will suggest themselves to any true gardener, and the herbaceous border must not be overlooked. A clump of hardy carnations and Pink hybrids is an attraction all the summer, while their use as a carpeting under standard roses, or as an edging to a bed, is difficult to improve on.

SUMMER BEDDING

The practice of raising carnation seedlings for flowering in the garden during the summer is becoming increasingly popular, and the Perpetual Border Carnation is the ideal section for this purpose. The best practice is to sow the seed in the late spring or during the summer, growing them on in the way previously advised, and either plant the seedlings out of doors in early September or else winter them in 3- or 5-inch pots in a cold frame or cold greenhouse. As a rule, the seedlings do not require any stopping, but if a bud is being formed in the late autumn, this should be removed with a few inches of stem.

CHAPTER XII

FOOD FOR CARNATIONS

It is now being proved, even to the most sceptical gardener, that any fertilizer which he may happen to have on hand will not do for carnations; they require a special diet.

The man who raises prize livestock makes as close a study of their food as he does of the stable in which they are kept. The horticulturist must do the same, yet few really give this matter serious thought. Invariably the success of a grower does not so much rest upon his greenhouse or soil as on the plant food that is added to the soil.

Feeding carnations is like eating. It is not easy to say what particular part of your diet does you the most good; on the other hand, it is often easy to find out what did you the most harm, and that is why I believe that the study of fertilizers must be backed up by practical knowledge.

Space will not permit me to give a very detailed account of the various elements of vegetable life, so I will deal with this wide subject of "Carnation Manures" under the broad heading of "The Chemical Tripod of Carnation Culture"—viz., potassium, phosphorus, and nitrogen.

To add to the soil an additional supply of that of which it already has more than sufficient will not in any way invigorate or stimulate a plant's growth, but rather have the opposite effect.

From experience it has been found that nitrogen stimulates a rapid leaf and stem growth, leaving the plant, if not fortified sufficiently by other food, soft and sappy—that is, an abundance of leaf and stem is obtained at the expense of flower. Phosphoric acid and potash build up a steady, firm growth, with large flowers of good substance.

It is ridiculous to endeavour to feed a carnation unless the soil is in a correct condition. A well-prepared compost will not only fix the existing plant food in the soil, so far as that is possible, but will prevent loss by evaporation of any additional plant food given artificially.

A carnation grown in a pot requires much more artificial food than one planted out. In the latter case, there is a greater surface exposed to the direct influence of the air, sun, and water, so that much more organic matter is turned into plant food. If the soil in pots or on benches is wet and heavy, the air cannot act upon it, and the plants do not obtain all they should from it; the minerals which all, or nearly all, soils naturally contain are prevented from performing their functions; the properties of the soil remain stationary; and no fresh food is made available.

Nitrogen has directly destroyed, or has been the means of the eventual destruction of more carnations than any one disease. The main reason for this is that many carnations are fed upon artificial fertilizers which are manufactured purely to give an immediate effect upon soft-wooded plants, and are not compounded for the purpose of fortifying and maintaining the constitution of the carnation. There is no other plant just like the carnation, and no general fertilizer will suit it.

Even when the mechanical part in the cultivation of the carnation—such as watering, ventilation, soil—is correctly done, if an unsuitable fertilizer is used—*i.e.*, one not compounded from a grower's point of view—then this early labour and care is thrown to the wind. But worse than that, the stock is physically ruined. It is not the weak, useless plant that is spoilt, because no one would think of feeding it, but the strong, vigorous plant producing fine blooms, which is invariably overfed in the first place. Here, in my opinion, lies one of the greatest dangers, and, perhaps, one of the primary causes of the rapid deterioration in so many varieties. A plant once overfed seems completely changed. Its constitution is shattered. It may continue to have a very strong appearance outwardly, but the enfeebled condition is handed down to its progeny by cuttings, to a much greater degree than is generally recognized, simply because it takes time to reveal it.

THE USE OF FERTILIZERS

It is just as essential that there should be a quick, vigorous growth in plant life as in animal life, but the whole matter rests upon correct food.

We will take, for instance, a seedling carnation. The young plant starts from a seed. The seed contains an embryo or germ which is extremely rich in albuminoids, fat, phosphates, and potash. It also contains a store of concentrated plant food intended to nourish

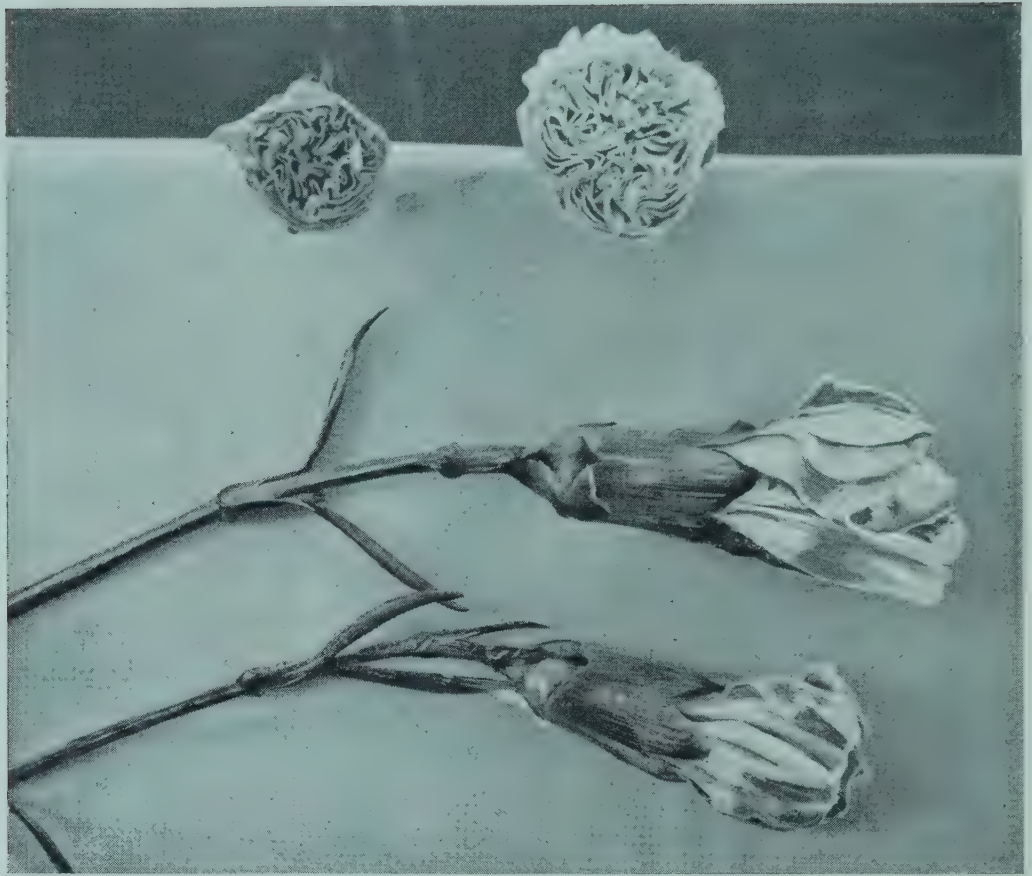
An autumn-planted Perpetual
Border Carnation, showing its
condition the following spring.



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Left: Seedling Perpetual
Border Carnation, nine
months old. Right: Seed-
ling Border Carnation,
thirteen months old.



The comparison between buds from a correctly fed plant and from a plant which has not been fed at all.

the young plant until the roots and leaves are sufficiently developed to gather their own support, and until it reaches this stage all depends upon the parent plant which bore the seed.

The future health and vigour of the plant will depend on the amount of food available in the tiny rootlets sent out by the young plant, on the soil being warm, on an abundance of sunshine, and a sufficient supply of oxygen and carbon dioxide. If the roots and leaves quickly come in contact with nourishment, the development will be rapid. The plant requires oxygen for respiration. It gives off water from its lungs, or the leaves; it assimilates food; it breathes—*i.e.*, gives off carbon dioxide as a result of the oxidation of its food.

SOURCES OF PLANT FOOD

The plant's food is derived from the atmosphere and from the soil. From the atmosphere it gathers carbon dioxide and oxygen; some plants collect nitrogen—but not carnations.

There is an abundance of air around the leaves of the plant, but if the soil is not open and porous there may not be enough in contact with the roots, for air in the soil in which plants are growing is essential to their well-being. This ventilation of the soil is needed to supply the oxygen required to permit the roots to live. It is also required to supply free nitrogen for the use of the free nitrogen-fixing germs, and to remove the excess of carbon dioxide which is set free in the soil.

The presence of the chemical elements of fertility in themselves is not sufficient to ensure fertility. To serve as food for plants, they must be available at the roots. Water is absolutely essential, both for the solution of the food elements in the soil, and for their distribution in the plant when they are required.

NITROGEN

This is the most essential of all the elements of plant food. It is not only removed by the plant, but if the soil is allowed to remain idle, a large percentage of nitrogen is lost through drainage. It is also lost by evaporation.

Nitrates supplied in judicious quantities will stimulate the root action, and are to be preferred on that account for carnations. Their action is also more gradual and natural.

Nitrogen, which usually appears on the analysis as ammonia, affects the growth of the plant, and deepens the colour of leaves and

flower; but too much would produce an abundance of leaf and retard blooming.

In the absence of nitrogen, a carnation makes no appreciable growth. With only a limited supply, a plant begins its growth in a normal way, but as soon as the available nitrogen is used up the lower and smaller leaves begin gradually to die down from the tips, and all the plant's energy is centred in one or more growths. Nitrogen is the substance required in combination with small quantities of sulphur and phosphorus for forming protoplasm, which forms new cells and the young tissues of the plant. It will be seen that the judicious blending of nitrogen in a carnation manure is one of the most difficult and, at the same time, most important problems.

The chief source of nitrogen in organic form is from dried blood, dried meat, dried and ground fish, tankage, leather meal, wool, hair, waste cotton-seed meal, etc. Some of these, such as dried blood and meat, readily decompose in the soil; others, such as leather meal and cotton-seed meal, decompose very slowly, and as they are of no service to the plant until they do, it will be seen that the nitrogen in dried blood is worth more per pound than that in leather meal or any other substance which decomposes slowly.

IRON

This, in the form of sulphate of iron, is essential for the formation of chlorophyl, the term for colouring matter.

PHOSPHATES

Phosphates are found in all parts of the plant, but tend to accumulate in the upper part of the stem and leaves, and particularly in the seed. In short, phosphoric acid produces flowers.

The phosphoric acid in artificial manures is derived from compounds known as phosphates. Although phosphorus combines with various substances, such as lime, iron, and alumina, forming phosphates, phosphate of lime is the one generally used as the source of phosphoric acid in artificial manures. The phosphoric acid combined with organic substances, either animal or vegetable, is, as a rule, more quickly brought into an available condition than that derived from inorganic matter.

Phosphate of lime in bone and rocks is not produced in a form immediately available. To increase its solubility, the various

materials containing it have to be reduced to a fine powder, and are sold as ground bone and ground rock phosphate. The fineness of the state of division appreciably affects their solubility; consequently, the value of this form of phosphatic manure will vary considerably; but as a rule the finely ground samples are much adulterated.

BONE MEAL

Phosphoric acid is always at hand, but too often in the form of phosphoric rock. Many people object to seeing the mould which appears in dull weather on the surface of the pots after being fed, yet this is undoubtedly the natural order of things. Twelve per cent. of the phosphoric acid in bone meal is immediately available and soluble in water, thus giving results at once, while the remainder slowly becomes available as the plant demands it.

For carnation growing the best source of phosphoric acid is raw ground bone flour. Steamed and boiled bone is not nearly so valuable, and is more adulterated. Good bone meal should contain a high percentage of phosphoric acid in an available form, otherwise the plants can derive but little benefit until the acid is made soluble by decomposition, which takes time. My experience is that any bone meal with less than 8 per cent. available phosphoric acid is unprofitable to buy.

For many years bone meal has been extensively used in America, intermixed with the soil for flowering stock, in the belief that it benefited the growth of the plants; but Professor Galloway, after extensive experiments, conclusively proved that bone meal used in that way was practically useless, and that it should only be applied as a top-dressing to established plants.

POTASH

Hard wood ashes contain an abundance of potash, but, owing to the varying qualities and expense, few modern fertilizers contain this valuable element. Any fertilizer with muriate of potash in it is unsuitable for carnations, owing to the presence of chlorides in it. Kainit contains a small quantity, and for carnation cultivation is also useless, as it makes the soil too sodden.

Rarely, if ever, is it necessary to feed a plant directly with potash, because most soils have a large reserve of this material, as it does not waste by evaporation or drainage in the same way that nitrogen does. By the addition of lime to the soil, a large quantity

of potash is liberated from the reserve and made soluble, and can be taken up by the plant.

Potash is one of the most important and least variable of all the elements in the ash of plants. It is quite evenly distributed throughout the leaves, stem, and seed, and generally occurs in the entire plant in the largest proportion of any of the essential ash constituents.

The function of potassium has apparently much to do with regulating the acidity of the sap by forming salts with the organic acids developed during the growth of the plant, and is a necessary element in giving sufficient stalk and strength of calyx to carnations.

Until the discovery of the mines of crude potash salts in Germany, the chief source of potash, other than that found in farmyard manure, was wood ash. At present the supply in Germany of the important potash salts seems to be practically inexhaustible. It is particularly valuable in the case of plants grown in light, sandy soil, but otherwise has little interest to the average carnation grower.

CALCIUM (LIME)

Calcium is a constituent of the stem rather than the seed, and seems to impart hardness to the plants. The exact function of lime is not clearly understood, but it seems to help in the construction of the cell walls. According to some authorities, its absence is felt in less time than either potash or phosphorus. It is claimed that a supply of lime is just as essential to the plant, in order that it may form cell walls from starch and sugar, as it is for the formation of bone in animals.

Lime is used by carnation growers, at more or less regular intervals, to destroy the acidity in soils, particularly in the spring of the year. The soil is simply dusted over with it.

Lime is used in the form of chalk or sulphate of lime, and is highly necessary in all carnation soils. It aids in fixing the nitrogen and liberating insoluble plant food.

SALT

Common salt, or sodium chloride, has, contrary to the general belief, no actual value as a fertilizer for carnations. The element sodium, which is one of the constituents of salt, is taken up by the plant in very small quantities, and is not essential to their development. The value of sodium chloride as a fertilizer lies in the fact



In isolated beds Perpetual Border
Carnations are most effective.



From left to right: The habit of growth of Border Carnation, Souvenir de la Malmaison, Perpetual-flowering Malmaison, and Perpetual Carnation.

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Left: The habit of growth of *Dianthus Allwoodii*. Right: Perpetual Border Carnation.

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A Perpetual Carnation house in summer.

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that it acts as a stimulant, and liberates some of the insoluble food materials in the soil. Potassium and phosphorus, two of the most important elements for the plant's growth, occur in the soil in insoluble compounds. It must be borne in mind, however, that the addition of large or continued applications of salt tends to wear out the soil.

Mechanically, salt has the power to flocculate fine earth, and thus dry, sandy soils are rendered more compact and able to retain moisture.

SOOT

Soot is one of those manures which are thoroughly appreciated by all, and, as Nicholson says, "It has the advantage over other manures in that it can hardly be misapplied." It is not, however, a flower producer or a complete fertilizer, but purely a nitrogenous manure, which adds size and lustre to the leaf and flower.

Soot should only be given as a liquid manure in the late spring and summer.

WOOD ASHES

I place a very high value on wood ashes. It is said that they contain all the mineral matter necessary to carnation growth, particularly soluble potash and lime, which are therefore readily available to the plant. They should be applied as a light top-dressing. Ashes from burnt garden refuse, or even burnt sods, are good, but of less value.

ANIMAL MANURES

The value of animal manure depends upon the food and age of the animal, and not so much upon the kind. For instance, pigs fed on peas would produce better manure than if fed on sharps. Manure from chickens and pigeons is very powerful, and much drier. They eat so many live insects that it is made rich in nitrogen, whereas if they were fed only on grain it would not be nearly so rich.

It is generally considered that 100 pounds of hen manure is equal in value as a plant food to $\frac{1}{2}$ ton of cow manure with straw, but the nitrogen in the chicken manure would act much more rapidly than the cow manure. The nitrogen, being obtained from richer and more digestible food, is much more active and in a more available condition, hence chicken manure must be used very cautiously for carnations.

The following gives a very rough idea of the nitrogenous value of a ton of each of the commoner yard manures:

Horse manure contains about 9 pounds of nitrogen.

Cow manure contains about 6 pounds of nitrogen.

Sheep manure contains about 11 pounds of nitrogen.

Pig manure contains about 12 pounds of nitrogen.

Chicken manure (fresh) contains about 32 pounds of nitrogen.

In regard to potash, chicken manure would be about—

Twice as rich as horse manure.

Eight times as rich as cow manure.

Five times as rich as sheep manure.

Three times as rich as pig manure.

In phosphoric acid, chicken manure is about—

Four times as rich as horse manure.

Ten times as rich as cow manure.

Five times as rich as sheep manure.

Four times as rich as pig manure.

It must be remembered in regard to farm animals that liquid manure is far richer in plant food than is solid excreta. In the manure of the hen, the solid and liquid excreta are in combination, which accounts for the high value of this substance, if collected and stored in a dry state. In the case of pig and cow manure, the great amount of moisture they contain makes it essential that the liquid manure is collected.

FEEDING CARNATIONS

The fact must be appreciated that the carnation, like other plants, cannot select its own food by sense of touch or smell, but simply takes that which is brought in immediate contact with it for good or ill. Plants have no means of letting us know what they want, except by showing signs of distress when, as a rule, it is too late to rectify the wrong. It is only by study and close observation that we can learn the requirements of our subjects, what to give and when to give it, and it is the latter point which is receiving our immediate attention.

No carnation should be allowed to get into a checked or starved condition at any season of the year through lack of food. It should be either potted or fed.

It is in bright, growing weather when carnations require the

bulk of feeding, from February onwards, and if the correct food is used, better results are obtained from flowering plants than by potting on into larger pots.

LIQUID FEEDING

In feeding a carnation with liquid manure water there is a certain amount of risk and extravagance in the form of waste, for while a plant which is in a medium degree of moisture will receive and greatly benefit by the manure, one which is too dry will absorb too much food at once, and another which is too wet will, if watered with manure water, be materially injured, if not killed. Further, if all are not fed at one time, it is highly probable some will be missed.

In using a good carnation food as a top-dressing, each plant receives its allotted portion to absorb at its leisure, while an exceptionally vigorous plant can easily be given a little larger quantity. A good carnation fertilizer should be a complete diet.

At all times great care must be taken in feeding carnations, because, if once this is overdone, it cannot be undone. It should be remembered that certain varieties can stand more artificial feeding than others, but with a mixed collection the more difficult varieties should be studied, and the quantities to use of a good carnation food should be taken from this standard.

LIQUID YARD MANURE

Too often we hear the purely practical gardener recommending only the use of what we will call purely natural manure for artificial feeding, such as the liquid manure from the stable, pigsty, or cowshed, because, as he puts it, "You know what you are givin' 'em." I must contradict such a statement, and say that this is precisely what you do not know. The strength of these liquid manures varies from day to day. There is always the great danger that the cattle or horses may be doctored with medicine, or some foreign matter may become intermixed, which would do irretrievable damage to the plants; while, for carnations, such manures as a rule contain far too much nitrogen.

Do not let me be misunderstood. I do not wholly condemn the use of liquid manures as food for carnations, but mention it more in a general way, so that the inexperienced will not rush in blindly, and think that they can be used without any risk, for while such manures may be perfectly safe in the hands of old veterans of horticulture, it is much wiser for others to use some specially prepared

carnation fertilizer in which there is no variance, and also no danger if the directions given are followed.

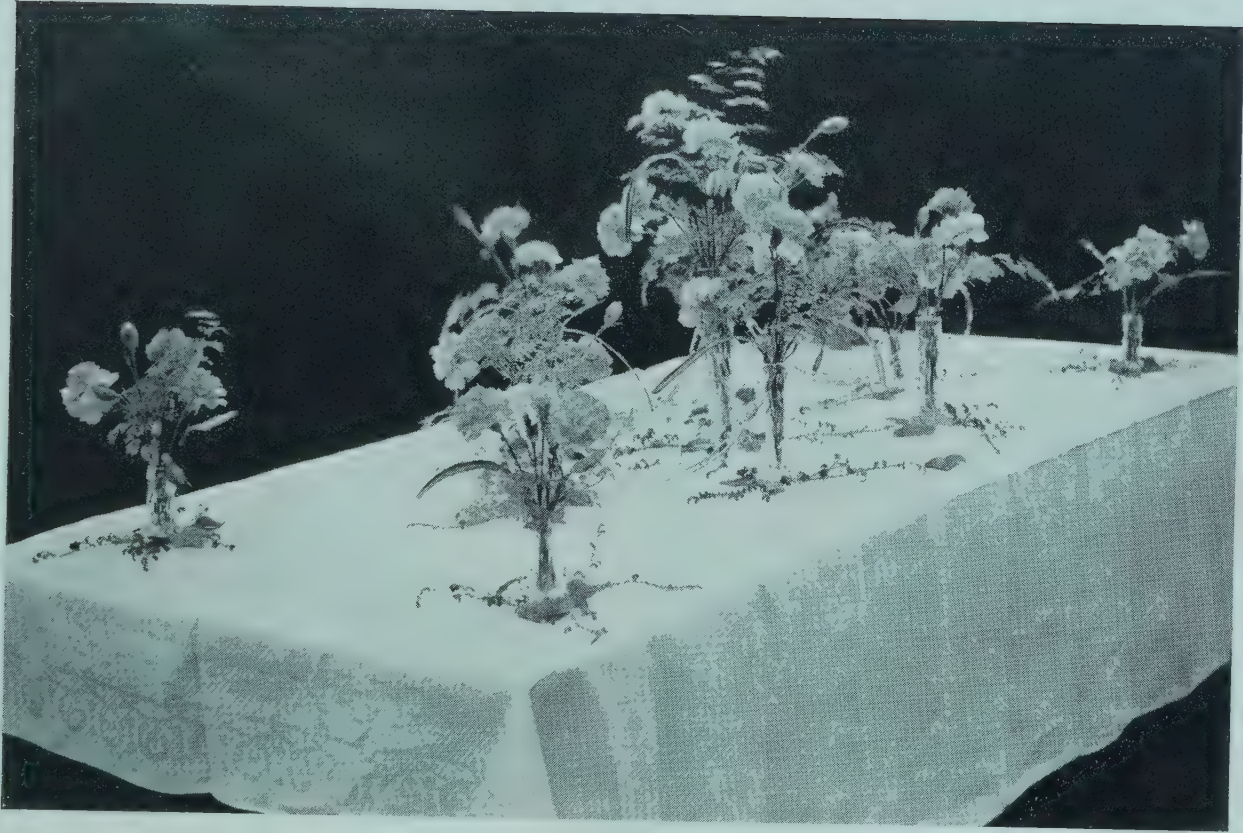
The way in which such manures as soot, blood, hen or any animal manures, are prepared for feeding carnations in a liquid form is as follows: Get a cask or tub—taking care that it has not previously been used for anything which would prove deleterious to the plants—and fill it with water. Place the manure in rough sacking, and put it in the water to soak for twenty-four hours. Use the extract or “tea,” but no thick sediment. The usual quantity of manure placed in a 36-gallon cask is $\frac{1}{2}$ bushel. The liquid is diluted at the rate of $\frac{1}{2}$ pint to 2 gallons of water.

For carnations, to benefit fully from the use of artificial manures in a liquid state, it is necessary for the soil to have considerable vegetable fibre incorporated with it. In heavy, dense soils, it is extremely difficult to use liquid artificial manures, owing to the acid condition which is so easily created.

MANUFACTURED MANURES

It is surprising how a gardener will take the greatest possible care in selecting his soils and varieties of plants, and yet choose his fertilizer in a thoughtless way. Tell him his soil is wrong, and he will believe it; but tell him that he is using the wrong fertilizer, and he will tell you he has been using it for years. Too often a loudly declaimed analysis is considered enough, and no investigations are made as to the parts which compose the fertilizer, organic forms, or otherwise. To be good it must do more than appear good on paper; it must prove good after a season's test; and no fertilizer is any good if not pure.

A good, evenly balanced carnation food, built up on the lines I suggest, should not only be quickly resolved into its elements, but should impart a mellowness and balance to the soil.



The Carnation is one of
the most beautiful of all
flowers for table decoration.



The old-fashioned Pink, with its sweet scent and splendid blooming capacity, should find a home in every garden.

CHAPTER XIII

DISEASES

NEARLY all diseases arise from propagating weak and poor cuttings. Disease is increased by propagating cuttings from a tainted stock, rooted or grown in too great a heat, or, what to-day is most common, from plants grown in old soil which is excessively fed with chemical fertilizers, and thus weakened. Insufficient air is another cause. The constitution of varieties is undermined and destroyed by these practices, and they become the easy prey of disease, and pass out of cultivation; or, as we have tried to make plain in earlier chapters, many varieties are raised which have the germs of disease hereditary within them.

It has been the wont of inexperienced people in times past to associate carnations with disease. If an attempt to grow the Divine Flower failed, it was because of some disease, and was not, by any means, the fault of the grower. But now that the flower's simple requirements are more generally known, we hear less of disease. Even rust, which used to unnerve quite experienced gardeners, has now lost its dread, not that the danger of it is less, but simply that we understand it more, and know how to cope with it in the right way.

RUST (*UROMYCES CARYOPHYLLINUS*)

This disease first became known in 1892, and it so frightened some growers at that time that they ceased to grow carnations. It is, perhaps, the most common of all carnation diseases, and yet the least to be feared. There are few varieties proof against it; yet both the cultivation and the variety must be distinctly bad for the plants to suffer serious harm from its attacks. The red varieties appear to be the most susceptible, and, as a rule, varieties which have the rich, bluey glaucous foliage resist it best. Invariably those with the light green leaves are more open to the attacks of this and all other fungus diseases.

This disease is so characteristic that there is no mistaking it. The first indication in the plant is a slight swelling, either on the

stem or the leaf. As the fungus matures, these spores, which cause the swelling, become brown in colour. Eventually the swelling ruptures the epidermis and exposes the mass of spores, which have the appearance of snuff. This is the fungus in its perfected form.

A peculiarity about this disease is that it reproduces itself from two classes of spores. The first, called "uredo" spores, will only germinate in a moist atmosphere as soon as they are liberated, but quickly lose their vitality in a fresh, dry one. These spores are easily scattered about by wind or draughts. It will be seen that this disease spreads rapidly under favourable conditions—viz., a close, damp atmosphere, which should seldom exist in a carnation house. A short time after the development of the first spores a second kind is produced, termed the "teleuto" spores. These second spores will not germinate immediately after development, but must first pass through a stage of rest, serving the purpose of tiding the parasite over any unfavourable period, during which the spores might fail to vegetate. This can be easily proved by anyone who will take a few plants affected by this disease, and place them with some clean plants, promote favourable conditions, and watch the developments.

Rust is a disease about which much has been written, and elaborate remedies and preventives recommended. The best remedy is to promote in the greenhouse the conditions least favourable to its existence—viz., air between plants, good light, airy houses, a dry, normal atmosphere, even temperature, absence of moisture on the leaves, earlier housing, and stronger, healthier varieties. The last point is, perhaps, the most important one of all. Varieties with good, healthy constitutions are wanted which, to a certain extent, can resist disease, not those which in a bad season are rendered almost useless. I believe one of the best remedies for a small grower is to isolate the affected plants, and allow the disease to exhaust itself. Almost all fungoid diseases spread, as it were, in cycles. These, under correct cultivation, work themselves out, and leave the plant, beyond the outward disfigurement, little the worse for the attack. It is very evident that when we spray a plant we can only reach the fruiting spores, so that while we reach the spores by the different sprays recommended, the fungus itself retains its vitality within the plant, and continues to give off the fruiting spores until it is exhausted. I have never seen a healthy carnation plant killed when attacked by rust, although I have frequently seen the strongest and most vigorous plants affected by the disease to such an extent that for a time the growth was

stopped. Nevertheless, after the disease had fruited for a certain period, the plants seemed to recover from the attack, and grew as vigorously as before.

The Best Remedies for Rust on Plants Under Glass.—As a prevention the following conditions should be observed: The foliage should be free from moisture or condensation during the night and on dull days. A free circulation of air should be about the plants at all times. They should be kept in a vigorous, growing condition. Maintain a pure atmosphere, as cool and dry as is compatible with healthy growth. Water with great care, keeping the plants moderately dry at the root.

Cut off all affected leaves as soon as the parasite is discovered, before the spores rupture the epidermis. Leaves so removed should be immediately burnt.

Dust the plants with a recognized carnation fungicide powder, which should be renewed each week. Upon a very bright day it is possible to syringe with carnation fungicide spray. This is the remedy I most strongly recommend for all fungoid diseases upon carnations. Its action is to stop the spread of the disease, which, under correct conditions, must eventually disappear. Hardy varieties growing out of doors are rarely affected with rust or any fungoid disease, if the soil has a free drainage and does not lack lime.

Quite a good remedy is to paint the hot-water pipes with a mixture of lime and sulphur, as advised for red spider.

Spraying with Bordeaux mixture is also beneficial. Put 6 gallons of water in a tub or barrel, and hang in it 4 pounds of pulverized copper sulphate in burlap, or other coarse sacking. Take slaked lime, adding water only as fast as it takes it up, and pour together. Before using, dilute to 40 gallons. Enough lime should be added to neutralize the acid. If this is not done, it might injure the foliage. To test this, get a pennyworth of ferrocyanide of potassium from a chemist, and place it in a small bottle of the liquid. If it turns brown, the lime is deficient, and more should be added, until the ferrocyanide has no effect. A slight excess of lime is desirable. When using this mixture it must be thoroughly agitated, so as to prevent the precipitation of the lime and copper sulphate. Syringe at a time of day when the sun will not act on the mixture, but it must be understood that this mixture invariably marks the carnation foliage. For the benefit of the amateur, I may say that Bordeaux mixture can be procured ready for use, and is generally considered one of the best remedies for all fungoid diseases.

SPOT (*SEPTORIA DIANTHII*)

This is readily recognized and easily distinguished from other fungoid diseases, because the spots are circular or oblong in shape, with a brownish centre, bordered by a dark band, purplish in colour. The whitish centre of the spot is dotted with minute black points, which are portions of the fruiting spores projecting through the epidermis. Sometimes the spots appear upon the stem of the plant.

As a rule plants are attacked by it in the summer season; a sudden change in the weather, from heat to a damp, cold spell, often causing it to break out, while damp, low-lying districts are more often visited by this disease. Any greenhouse variety apt to be affected is best housed before the heavy autumn dews set in. No matter at what season of the year its presence is discovered, the plants are more easily doctored under glass; fortunately out-door kinds are rarely affected. Cut off all the affected leaves and burn them, then dust the plants with sulphur and lime in equal portions. I once saw a small batch of plants which were badly affected cured with two dustings of fungicide powder. This destroys the spores of the fungus.

One of the main points is to keep the plants growing as vigorously as possible, and they will soon throw off the disease. If they are perfectly free from red spider, it is best to dispense with the syringing entirely. Remedies advised for rust are equally effective in the case of spot. Give all the air and sunlight possible. Watering should be done with care, and at such a time as will permit of all excessive moisture evaporating before evening. Of course, sunny days should be selected for the bulk of the watering, and all that is possible should be done to induce the plants to produce a hard, robust growth. Such conditions will greatly check, if not entirely eradicate, almost any fungoid disease on carnations.

DRY ROT

This disease causes the branches of the plant to wither up and die. It is a rare visitor, but when it does occur there is no cure for it. Modern varieties undoubtedly are not nearly so subject to it as those of earlier date. The main reason for this is that they make a much stronger and firmer growth; also they are much more alive generally. A complete carnation food is a powerful factor in warding off this disease. Dry rot is closely associated with stem rot, and the remarks regarding the latter apply to it also.

FAIRY RING SPOT (HETEROSPORIUM ECHINULATUM)

England has the doubtful distinction of creating this insidious disease. It is totally different from *Septoria dianthii*, in that the vegetable threads growing within the leaf tissue exhaust the substance at certain points, so that there appears a nearly circular spot.

The spores are brown in colour, and, when produced in great numbers with the threads, darken the spot. At this stage the spot possesses different shades of colour, according to the number of spores produced. The growth of the fungus from the centre of the spot is centrifugal, and the darker colour is apt to be arranged in concentric lines representing a miniature fairy ring, hence the name.

The same conditions which favour rust and spot are also favourable to the fairy ring disease. The grower who is rarely troubled with those fungoid parasites is the one who understands his subjects.

Precisely the same steps should be taken as advised for spot and rust, particularly cutting off affected leaves and burning them. It cannot prosper in a cool, dry, fresh atmosphere. Houses situated at a high elevation are rarely, if ever, troubled with fairy ring. In the east of Scotland, I understand, stocks keep free from fairy ring owing to the dry, hard, and bracing air.

BACTERIOSIS OR STIGMONOSE (BACTERIUM DIANTHI)

This disease is not to be taken so lightly as has been our wont in times past. In appearance it is simply yellow translucent spots on the leaves. These are destroyed cells, and are seen plainer when the leaf is held up to the light, or in the early spring of the year.

We know that these spots on the leaves are caused in the first place by such sucking insects as thrip, red spider, aphides, etc., and we look upon them as present memorials of a past evil. This is where we have been wrong, because in reality it is a disease caused, in the first place, by some sucking insect, which has the power of self-propagation, and which can only be stamped out by following definite lines.

The theory of the disease is simply this. After the insect has withdrawn its proboscis from the young leaf, it leaves a poison in the leaf cells which, under favourable conditions, becomes a permanent disease. That these punctures are primarily the cause of this disease I have no doubt, and I think it quite possible that this poison may grow and permeate the whole plant, and its offspring in the way of cuttings, without fresh punctures, provided that the

health of the plant has been weakened by indifferent cultivation or old age. I hold that the development of materialization of the disease greatly depends upon the condition of the plant at the time, and the after-treatment received.

Naturally, varieties with a robust constitution, whose foliage is rich and deep in colour, and—what seems to us to be more important—plants grown in a light, airy position, are better able to resist the attack and throw off the poison deposited in their system. On the other hand, in the case of a plant which has been grown under unfavourable conditions, and is suffering from a weakened constitution, the poison is able to take up a firm position, and gradually permeate all its members; and unless better culture is given to these plants and their offspring, they will become most unprofitable to their owner, producing only a yellow, spotty growth, poor bloom, and a very indifferent crop.

The means by which this disease may be exterminated are: Keep the plants as free as possible from all insect pests. Take the greatest possible care in the selection of cuttings and layers, not only in the cutting itself, but the actual parent plant. Grow plants in as light and airy positions as possible, encouraging a slow, hard growth. Under such conditions, with unerring care, it will take three years to purge a variety from this disease, so that in the case of old varieties—considering the ever-increasing number of new and improved varieties—it is best to discard them.

A change of stock has a marvellous effect, and fresh, maiden loam at each potting or planting is absolutely essential. It is well-known that the system of rotational cropping to retain health and vigour is resorted to in agricultural crops, and it must be so in planting carnations. It is not logical to suppose that this flower is an exception to this general rule. Disease is less liable to attack plants full of vigour, and that the vigour is increased when the plants are grown in fresh soil is an agreed point.

STEM ROT (RHIZOCTONIA)

This disease causes the stem of the plant to decay at the collar, on the surface of the soil, cutting off the food supply, and hence causing the entire plant to die. Fortunately hardy out-door varieties are rarely, if ever, attacked.

It is perhaps the most dreaded disease in hot climates, and its presence is something to be feared. The bench system of cultivation naturally lays the plants more open to the attack of stem rot than

cultivation in pots. Too often when a plant dies the cultivator consoles himself that its death is caused by some insect, and so drops the matter. Instead, it may be the commencement of some fungoid disease which calls for great care and activity.

Some growers of note say that it is an hereditary disease, and to a certain degree this is probable. We can undoubtedly trace its origin in the majority of cases to too rich a soil. One which has been stacked a long time with an abundance of manure provides conditions most favourable to its creation. A moderately fresh, sweet loam with a correct quantity of lime, which has not been stacked more than nine months, makes the plants almost proof against stem rot.

Curative and preventive means of fighting this disease are fresh air and an absence of decaying matter in or near the houses. Dust the plants and surface of the soil with a fungicide powder or air-slaked lime. This is better than syringing with any fungicide, because it has a drying tendency, whereas liquids supply one of the chief elements which the fungus requires. To stir the soil, and allow air and sun to act upon it, is a most excellent practice. In the case of plants grown planted out in greenhouses, it is most essential to substitute new soil at all times when replanting or replacing a plant.

A little lime in the soil—in the form of old mortar rubble or chalk—has a beneficial effect. One of the most noteworthy features of this disease is that it always disappears in a cold, dry atmosphere.

Deep potting or planting, in any stage of the life of the plant, will often cause stem rot. In the case of cuttings being rooted, if there is a fear of any of this fungus lurking in the sand, spray it with a weak solution of sulphate of copper. Plants or cuttings which have become hard through a check for want of potting or proper attention, are more readily attacked. The result of eelworm is closely allied to stem rot.

BUD ROT (ATTRIBUTED TO *SPOROTRICHUM ANTHROPHILUM*)

This disease causes the affected buds to produce deformed flowers, or the buds decay when only partially opened. Generally, however, the buds entirely fail to develop, and if examined the petals and other parts of the flower will be found completely decayed. Sometimes the bud is attacked when quite small, and it is then killed, and turns brown. The stamens are affected first, and afterwards the lower portions of the petals.

It is said that the sporotrichum produces two kinds of spores—one

globular and non-septate, the other elongated and generally once-septate. A mite is constantly associated with this disease, and some writers believe it to be the cause. I believe it to be purely the effect, because it has been found possible to inoculate young buds with the spores, but with no certainty by the mite.

It never occurs where plants are well grown. The primary cause of it is poor drainage, which keeps the soil saturated, too much moisture in the air promoting conditions favourable to all fungoid diseases. Of course, in the very late autumn perpetual varieties out of doors have bud rot caused by heavy dews.

Stagnant, impure air, through lack of ventilation or bad surroundings, also a weak light, will cause bud rot in greenhouses. Plants, if lifted and potted and brought into the greenhouse, often fail to develop their buds; the cause of this is the check of lifting.

The fungus which causes bud rot does not seriously affect the plant itself, because it is purely confined to the buds, except that the conditions which create and which are favourable to the disease are most harmful to the general health of the plant.

As a remedy, pick off all affected buds and destroy them by burning. The plants should be gone over every day.

CUTTINGS DAMPING OFF

This can hardly be classified as a disease, but it is looked upon as such, and is known as bench rot.

The damping-off of cuttings is well known to all those who have had experience in propagating soft-wooded plants. The fungus travels along the surface of the soil or sand, causing the cuttings to damp off. It spreads very rapidly, and will destroy dozens of cuttings in a single night, whether rooted or otherwise. It is invariably created in the first place by decaying matter.

Scrupulous cleanliness and fresh, clean sand for every batch of cuttings are the best preventives. Remove any cutting as soon as it shows signs of not rooting.

Defer spraying the cuttings in dull weather. Avoid too heavy shading, but do not allow the cuttings to flag owing to a drought or excessive light. Beware of too close and humid an atmosphere.

Very dry sand will check the progress of the fungus if sprinkled on it. The best plan to stop the spread of this disease is to remove the cuttings, wash them, and thoroughly clean out the cases and refill with fresh sand.

Carnation rust.



71



Mildew on Carnations.

72

Fairy ring spot.



73



Curled leaf tips are caused by a check.

74

SPLIT CALYX

This is, of course, not a disease, but so many amateurs imagine that it is, and seek to know the why and the wherefore of it, that for want of a better position in the book I deal with it here. With certain varieties splitting is general, and cannot be avoided—such varieties should not have been put in commerce—but I am dealing with standard non-splitting varieties, which split owing to unsuitable conditions. The general reasons given for carnations splitting their calyxes are irregular conditions, temperatures, or, rather, extremes or sudden changes, over-feeding, extremes in moisture, and irregular or bad light. A steady, regular growth will prevent varieties from splitting. It will be evident at once that an unsuitable fertilizer, especially one in which an excess of nitrogen is found, is one of the principal causes of this defect.

CURLING OF LEAF TIPS

This is not a disease, but is caused by a check. Often an uneven development of the plant arises, through late housing, irregular temperature, a long, dull spell, or perhaps the plant has been allowed to become starved and then fed. Some varieties are much more subject to it than others. It is best to assist the leaves to unfold, if possible, and give normal treatment.

CHAPTER XIV

INSECT PESTS

INSECT pests are among those things which no one wishes to keep. They call for instant action. The old maxims, "Prevention is better than cure," and "A stitch in time saves nine," apply more strongly to garden pests than anything else, for in the case of green fly or red spider it may save not nine, but nine millions. At the present time, however, it is known how to combat all carnation pests, and the dread of them is rapidly becoming less.

Under correct treatment, carnations live healthy lives. But the watchful cultivator who detects the presence of the enemy at an early stage—when eradication is quick and easy—saves time and money.

RED SPIDER (*TETRANYCHUS TELARIUS*)

This is a small red mite, closely connected with the cheese mite, which attacks the old or fully developed leaves. It increases very rapidly, and quickly spoils a plant by causing the leaves to turn a dull, rusty colour, and afterwards to die. It flourishes in a dry, hot atmosphere, and is fostered by highly heated pipes, or a dry heat.

Stigmonose, and several other diseases, are nothing more nor less than the after-effect of this pernicious little insect, which is capable of doing more harm than is generally credited. The long, dry, sunny periods, which ripen the wood of the young stock, cause the older leaves to curl, thus forming an ideal home for it, of which it is only too quick to take advantage.

If the plants are out of doors, the summer dews will have a very telling effect upon this pest, particularly so if backed up by heavy sprays during the day, so that affected plants in pots are best placed out of doors.

At present there is no vaporizer or fumigant that is able to exterminate red spider, and nearly all effective remedies are used in liquid form. To charge the atmosphere with moisture in a greenhouse will not destroy red spider, and does but little to check it. A well-directed force of water must break the web and strike and

dislodge the insects. No matter what liquid agency is used, the force with which it strikes the insect plays an important part, if, indeed, it is not the whole crux of the matter.

There are several remedies, each of which has claims to being effective. The best at present is to use an insecticide spray that is mainly composed of nicotine, but in winter for plants under glass insecticide powder is used. Another remedy is to dissolve 1 ounce of common salt in a gallon of water. This should be sprayed on in the early morning with a very fine spray, reaching every part of the plant, particularly the underside of the leaves, and a few hours after it should be washed off with the hose or syringe. This is not done with the idea of washing off the salt, for that would do no damage if it remained, but to wash off the red spider.

Boil $\frac{1}{2}$ pound of ivory soap in a gallon of water until dissolved. When applying this liquid, dilute with clear water in the proportion of 1 in 10. This should be applied early in the morning, and washed off later, in the same way as recommended for salt water, but do not spray it on with quite so much pressure, the object being to coat the entire plant with the soap solution in the first place.

Sulphur fumes are an effective agent against red spider, but if used to any great extent they injure the plants, and many people have injured their stock with them. These are generally administered by painting the alternate lengths of the flow pipes with a mixture of 3 pounds of lime to 1 pound of sulphur, made liquid with water, when running artificial heat. See that a little air is left upon the house at first, or it will affect the colour of the blooms. Renew the sulphur each fortnight.

THRIP (*HELIOTHRIPS TABACI*)

This is a very small, winged insect, which lays its eggs principally inside the calyx of the carnation when the bud is quite small. It causes great havoc during a hot, dry spell in the summer, particularly in very hot countries. Different from red spider, which confines its attack to the epidermis of the foliage, thrip attacks the young growth, getting into the very heart of it, often effecting the damage before it is discovered. Being a sucking insect, it feeds by piercing the tissue and sucking the contents of the cells. Like aphides, it cripples the growth or disfigures the flower while yet in the bud form, leaving white blotches on coloured flowers, and a grey appearance on the leaves.

The thrip is more or less sensitive to bright sunlight, and generally

seeks shady positions during the day. Like red spider, it enjoys a high temperature. It does a greater amount of injury to carnations in the autumn, and some varieties are more subject to it than others.

I have noticed that very early in the morning, before the sun has risen, the insects are to be seen upon the outside of the buds.

Simply to fumigate or syringe the plants affected a single time will not get rid of this pest, because, as we have seen, many of the insects cannot be reached owing to their being hidden in the folds of the leaves and in the buds. Further, owing to their great activity, they quickly reach a place of safety in the axils of the leaves or in the soil. The eggs are proof against all efforts, and the insects are propagated so rapidly that persistency in vaporizing with almost any of the advertised exterminators is the only remedy, while spraying with a carnation insecticide should be done each third day. This is undoubtedly the best remedy, particularly so with plants out of doors. Nicotine extract is sudden death to all it can reach.

A most effective method for plants under glass is to fumigate with cayenne pepper. Heat some small pieces of iron, place them about 20 feet apart in the paths of the house, then put a spoonful of pepper upon each piece. Of course, the ventilators should be closed, and the operator will have no personal desire to remain in the house. To be effective this practice should be carried out twice during a week.

Sulphur and lime upon the pipes, as advised for red spider, has a very telling effect upon this tiresome insect. During the winter, or in dull, damp weather, insecticide powder should be used.

GREEN FLY (APHIS)

This is one of our common, everyday enemies, about which everyone knows, and rarely is the progressive grower to any extent troubled by it. He knows how rapidly it increases and acts accordingly, preferring to exterminate the few rather than the many.

In addition to the true males and females there is a race of wingless, viviparous insects which are produced from eggs that are deposited in the autumn, and, after lying dormant through the winter, are hatched in the spring. These also produce their kind.

Few, if any, of the many insecticides sold fail to prove a deadly weapon to fight and destroy green fly, and almost any of the well-known home-made remedies are equally good. There is one point of vital importance which, I think, too many overlook, and that is



Hybrid Dianthus flourishing in a warm sunny spot at the edge of a rockery.



A perfect type of the Perpetual-flowering Carnation.

that it is quite easy for the remedy to be almost as bad and injurious as the evil. One may use an insecticide which truly kills the insects, but which also coats the entire plant with a deposit which stops up the pores of the leaves, as is the case with soft soap. This must be injurious to the health of the plant. Of course, it can be washed off, but this takes longer than is generally calculated, particularly so on the underparts of the leaves. For this reason we would recommend nicotine, which is the base of the best carnation insecticides, but bear in mind that tobacco fumes will spoil the half-opened and fully-opened flowers.

CUCKOO SPIT (*PHILÆNUS SPUMARIUS*)

This yellowish-brown insect sucks the sap from the plants, and exudes a frothy liquid from its body, which covers it and forms a shelter from the sun. It is wonderfully agile, and can jump many feet, quickly making itself scarce when disturbed.

The common theory as to its increase is that the female lays its eggs in the autumn on the shoots or leaves. These hatch out the following spring. But this belief is hardly practical, because we find them in the early spring on young carnation seedlings, a vestige of which did not exist in the autumn.

Undoubtedly, it belongs to the aphid family, and the same remedies in the form of sprays are the most destructive agencies.

BLACK FLY

Black fly on carnations is rather uncommon. The means employed to destroy green fly will be found effective if used a little stronger, and the same remark applies to white fly.

GRUBS AND BUTTERFLIES

Grubs, representing intermediate forms of insect life, mostly as caterpillars or maggots, constitute one of the most pernicious and destructive pests to which the carnation is subject. The butterfly and the moth are perhaps the most unappreciative insects, for in their flying form they content themselves with the light and innocuous fare provided by floral nectaries, and yet they deposit upon the stems and leaves of suitable plants immense numbers of eggs, which develop into a devastating brood of grubs. Hence, almost every moth and butterfly should be a sworn enemy of the carnation grower, particularly in the greenhouse, since a caterpillar rarely rests from

feeding from the time it is hatched out until it enwraps itself in a cocoon in some secluded corner as a prelude to the butterfly stage.

The most commonly used means for the destruction of grubs in the soil is air-slaked lime. Sprinkle it on the soil and water it in. Use enough to cover the soil, but not too heavily.

CATERPILLARS

These vary much in their habits. Some feed by day, others by night, hiding themselves in the soil, and sallying forth under cover of darkness. The day feeders are easily discovered, since their droppings betray their presence, whilst the night feeders are, as a rule, to be found buried under the surface of the soil, at the base of the plant they have attempted to destroy. A search with a light in the evening is perhaps the best way to discover and destroy them.

Such kinds as the "woolly bear" are wide rangers, and travel rapidly from plant to plant, leaving only partial wrecks behind them, but by giving the neighbouring plants a sharp shake, the pests are dislodged, and can be easily destroyed. Insecticide powder will destroy caterpillars if persisted with.

DADDY LONGLEGS

This insect is more correctly known as the crane fly (*Tipula oleracea*). When in the grub or maggot form, it is known as the leather-jacket grub. It is even more insidious and destructive than the caterpillar, because it attacks the very heart of plant life by devouring the roots. Unfortunately, most of this tribe are immune from all but such toxic remedies as would be fatal to plant life also. The same destructive agencies advised for wireworm should be used.

MAGGOT

Maggot is the larva of a small black fly, similar to the house fly (*Hylemyia nigrescens*), the female of which lays its eggs upon the foliage of the carnation, particularly the old border types, in the early spring, selecting young plants for preference. The eggs are deposited at the base of the leaves. When hatched, the maggots feed upon the epidermis of the leaves, and gradually work their way to a main growth, and finally into the stem itself.

The maggot is readily detected when feeding upon the leaves by the whitish track it leaves upon the surface. Then, and only then,

is the time to destroy it. Picking them off by hand is the only reliable means. The little brown pupæ, the chrysalis form of the maggot, when found, should be destroyed immediately. Another fly (*Phyloma*) conducts its habits of life in a similar manner, but rarely with the same dire results.

A reliable insecticide, as recommended for green fly, will hold them in check, by keeping the flies away from the plants in the summer.

CUTWORMS

These black and variegated little insects occasionally attack carnations during the summer, but rarely in this country, and injure them by cutting or gnawing off the foliage; but they do the most damage in the autumn, by boring into the flower buds just before the bloom opens.

The surest remedy is the primitive one of hunting for them with a light at night. They are not usually so numerous as one would think by the amount of damage they do. They are voracious feeders, and one of them will destroy much stock in a short time. If a freshly eaten bloom or shoot is found, the cutworm will probably be buried somewhere near, just below the surface of the soil.

A mixture of 1 part Paris green to 100 parts of bran, moistened with treacle, and placed on pieces of slate between the carnation plants, will often tempt these insects to a sudden death, but as this mixture is deadly poison, it should not be left lying about during the day.

Several soil fumigants are now obtainable, sold under registered names, and any soil subject to these pests is best treated with one of them.

EELWORM (*TYLENCHUS DEVASTATRIX*)

This is a much-dreaded pest, chiefly in the case of plants growing in too rich a soil. It is an almost invisible nematoid worm, with a more or less translucent body, and exists solely upon the tissues of the plants, causing a swelling and splitting of the stem, in many cases turning to stem rot. Invariably the plant does not die right out, but lingers on for a considerable time, while some even recover and flourish. As the name denotes, the little creature has the appearance of a miniature eel. It attacks the plant through the medium of the soil. This is one of the carnation's old and sworn enemies, and one for which, like a cold, everyone appears to have a remedy.

Formalin has proved of little value as a destructive agency,

while it is fatal to growing plants. Its use has been advocated as a soil fumigant, but these can now be obtained under various registered names; these articles should be procured and used according to directions. If you mix your soil as advised in Chapter III., and your plants are fed with the correct food, and if everything is sweet and clean around them, this pest will not trouble you; in short, eelworm cannot live in sweet, pure soil, so lime plays its part.

Once the eelworm has taken hold of the plant it is protected by the outer bark.

For sterilization it is necessary that the soil should be heated to at least 180 degrees, a higher temperature being better still. Freezing during the winter will also purge the soil of this pest.

After an attack of eelworms, the stages and everything else in which it is possible for them to lurk should be cleansed and lime-washed. The old soil should be removed from the neighbourhood of the greenhouse, and spread thinly out for freezing, or have some soil fumigant mixed with it.

WIREWORM

Wireworm is the group of three species of beetles: *Agiotes lineatus*, *A. obscurus*, and *A. sputator*. It is among the most deadly enemies of carnations, and is too well known to call for any description. The parent beetle lays its eggs near the roots of grasses or plants. From these, grubs with shiny, yellow-coloured bodies are hatched. This grub is the wireworm, which will live in the soil from three to five years. There it pupates, and eventually appears as a beetle.

In the open, repeated exposure of the ground by digging, and not permitting vegetation to grow on it for a period, is a measure that should be carefully carried out where the ground is known to be infested. On tilling land, a dressing of rape dust, $7\frac{1}{2}$ cwts. per acre, will attract the pest to feed upon it. When near the surface feeding, the ground should be dressed with mustard dress at the rate of $\frac{1}{2}$ cwt. per acre. Soot and gaslime are also distasteful to the insects. The Board of Agriculture suggests pouring $\frac{1}{4}$ ounce of bisulphide of carbon into a small hole made in the ground, at once covering it over with a piece of tile, with earth on the top. Care must be taken not to let the bisulphide touch the roots of any of the plants: it is poisonous, and also highly inflammable. A spoonful of bisulphide is sufficient to destroy the wireworms within a square yard.

I have a great belief in autumn and winter cultivation of land



A self-coloured Border Carnation.



A fancy Border Carnation.

for destroying wireworms and other pests of the ground; that is why I advocate preparing the soil in the field (see Chapter III.). It is important that this cultivation be done just before the frost sets in, so that the grubs and worms that are turned up towards the surface and exposed to the cooler temperature will not be able to get down into the soil again, and thus escape destruction by frost. This cultivation cannot be continued too late in winter, or be done too often.

Traps for this pest are made by burying pieces of cut carrot or potato, attached to sticks, near the plants. These should be examined daily, when the wireworms, preferring carrot to carnation, will be caught in the act of feeding. I always bury pieces of potato near special varieties planted in the field.

When a plant droops, the soil should be carefully cleared away from around it, when the wireworm will be found partially or wholly embedded in the stem. If you only bury the roots and not the stem of the carnations, and plant firmly, not one plant will be attacked out of a hundred in infested soil.

EARTHWORMS

These do not feed upon the roots of a carnation, like grub worms, but they completely change the texture of the soil, making it into a heavy sticky mass, which is unfit for the plant to grow in. The old practice of ridding the soil of earthworms whilst growing plants is to allow it to become dry, and then water with strong lime-water. This will cause the worms to come to the surface, when they can be captured. If sufficient lime is used, coupled with good cultivation, earthworms will only do good.

WOODLICE

Woodlice are more or less the enemies of carnations. They are naturally scavengers, but prefer carnation leaves. The houses should be kept as free as possible from decaying wood and other debris, as this is an ideal lurking-place for them.

The following is a good method of destroying them: Add sufficient Paris green to white granulated sugar to turn it to a light green colour, and mix with fresh bran. Place this in small quantities in their runs and other likely places. Do not expect to get rid of them all by one dose, but repeat it several times, a week apart.

They can be trapped with pieces of scooped-out potato or turnip, and shaken into hot water each morning.

ANTS

These energetic little insects are at times troublesome by carrying the larva and eggs of insects from one plant to another, also by burrowing into the pots. The best means of destruction are Paris green and sugar, or arsenic and sugar.

EARWIGS (FORFICULA AURICULARIA)

This insect is familiar to all, and there are few seasons when it does not abound. Carnations are one of its chief delicacies, particularly the flowers. The horticultural chemist has not discovered an effective preventive or remedy, so we still have to cling to the method of our fathers—viz., a small inverted pot, half-filled with dry moss, crumpled paper, or hay, placed on a stick; or lengths of rods, reeds, or stems of sunflowers, cut into lengths of 9 inches; shaking the earwigs into a vessel of hot water or paraffin oil and water.

SLUGS

The Field or Milky Slug and the Black Slug

These most injurious creatures are so well known that any description of them would seem to be superfluous, so I will only point out that the colouring of the field or milky slug is usually greyish, while that of the black slug is not by any means always black, but varies considerably, sometimes being almost white and sometimes greenish, brown, yellow, or other tones, invariably having stripes along the back and sides.

Dressings of quicklime or gaslime seem to be the only effectual remedy. Soot is also sometimes used with advantage, and where the plants are liable to be injured by the former, it is a good plan to surround them with a mixture of soot and fine cinder ash, as the slugs cannot pass over these; but to destroy them it is necessary to use the former, and it should be borne in mind that only repeated applications will take effect, as the slug can exude slime which throws off the lime, but cannot continue doing so if the treatment is persisted in for several successive evenings.

It should be observed that this is only effectual when applied in the evening, as the slugs are abroad then, while during the day they are hidden away, and escape the treatment until the lime has become slaked, which soon happens. Much trouble with these pests may be avoided if the surface of the ground is kept absolutely free from weeds and rubbish.

CHAPTER XV

GREENHOUSES FOR CARNATIONS

THE best style of greenhouse for the amateur or private grower of Perpetual Carnations is a subject on which, naturally, there is some diversity of opinion. Some think that all and everything depends upon the house, whilst in reality more depends upon the style of the grower than the style of the house.

Certain local conditions have to be taken into account. For instance, the site may be level, or it may be on a hillside; the climate may be warm, or it may be cold; the house may be open to strong winds or heavy falls of snow. These and many other factors have to be taken into consideration when building a greenhouse. For this reason, it is not possible for anyone to design any particular style of greenhouse and call it a model carnation house. Yet there are certain essentials upon which nearly all agree, such as winter light, air, and heat.

In studying this important matter, there are two aspects of the case which confront us—viz., the private and the commercial grower. While their objects are widely different, their requirements are similar. Both want a strong, durable, light, airy house at a reasonable cost.

It is unnecessary to consider all the various kinds of greenhouses from the ordinary wooden variety to the iron-framed, trussed-roof house.

To obtain adequate light it is essential that the house or houses should be situated in as open a position as possible, not overshadowed with trees or buildings, and glass panes of large size should be used, because the more woodwork there is, the less light is obtained. Wherever possible, thin iron purlins and uprights should be employed instead of wood.

DESIGN

The importance of the design of a carnation house lies, in the first place, in covering the most ground at the least expense, and securing the best circulation of air and heat. One can readily see

that no matter what the width of the house is, the cost of the sides is the same; consequently the wider the house, provided one keeps within reasonable limits, the less is the cost per square foot covered, so far as superstructure goes. The circulation of air is much better in a wide house than in a narrow one, and the wide house is also more easily heated, in proportion to the surface covered.

The even span-roofed house is the cheapest, and, for general purposes, the best.

I have no hesitation in stating which is the correct aspect for a carnation house in this country. It should run from east to west and face due south, for in this case it gets all the available sunshine during the winter when, as a rule, light is at a premium. In the case of a house running north and south, the sun, in the winter, when it is at a low angle, strikes the bars, which act as a lattice blind, and so the interior gets practically no direct sunlight. Then, too, the woodwork in the roof of such a house will cast more shade than is the case in a house set east to west. That is why no one should build, for choice, a house running from north to south for carnations. On account of this, some prefer houses with a long side to the south, and a steep pitch to the north, in order that when the sun is shining at a low angle during the winter, the shadow from the ridge is thrown off the house, until the sun gets higher in the spring, when it does not matter. Others favour a house placed facing a few degrees to the east, in order to obtain the full morning sun.

The pitch of a roof from which to get the best results—a point to be considered—is 32 degrees, or a rise of $7\frac{1}{2}$ inches to 1 foot; but with a pitch of 27 degrees, facing south, little, if any, fault can be found.

The best glass to use is that measuring 16 by 24 inches, placed the 24 way. I have heard people argue that carnations must be grown near the glass to prevent them drawing, or making a weakened growth, but in these days of $1\frac{1}{2}$ -inch rafter and 24-inch glass such arguments will not hold water, and there is no limit to the loftiness of a carnation house, provided that there is practically no shadow, because it obtains as much light, almost, as there is outside. The body of air which is above the carnations is a matter of importance, if there is buoyancy in it.

STAGES

For pot cultivation one of the best stages is one built of wood or iron, covered with corrugated iron, slates, or tiles, preferably the latter, which in turn should be covered with ashes or washed

shingle, the latter being of great assistance during the late spring and summer months, if kept moist, in checking red spider.

An open wood lath stage is only beneficial in the winter time, giving as it does a more free circulation of air around the plants. A stage 2 feet from the ground is ideal, care being taken that the hot-water pipes are not too near the top of the bench. It is an excellent plan to keep ashes that are perpetually moist during the summer months under the stages.

VENTILATION

The ventilation must be adequate to cope with the hot sun of March and also with the late summer weather so often experienced in September. Continuous ventilation on each side of the ridge is best, allowing for a maximum amount of fresh air with a minimum amount of draught. If separate ventilator lights are used with breaks of a pane of glass every 4 or 5 feet or so, some air is admitted, but in a small house there is more fear of a draught. It is much easier to admit a little air through a number of ventilators without a draught than a large amount of air through a few big ventilators.

All specially built carnation houses should have 4-foot glass sides, made to open as ventilators, also box ventilators made in the brick-work just above the ground-level, so as to admit fresh air beneath the stages for use in cold weather.

It is just as important to have ventilators at the ends as at the sides. In severe weather air admitted at the two ends of a house will keep up a gradual circulation, while in very hot weather such ventilators are absolutely indispensable.

HEATING

The actual amount of hot-water piping required for any one greenhouse must be decided individually, and is work more for an expert in that particular department. But this point should be borne most strongly in mind—that we can only imitate Nature when we have an abundance of piping mildly heated, which will give off a gentle warmth. Compare this with a greenhouse which has insufficient piping, and in which, during a cold spell, the fires are rushed. The few pipes give off a great heat, which, in turn, completely dries up the air, and is favourable to several insect pests.

The change of ideas is only in keeping with the times, and there is no doubt that the flow pipes running along the eave plates, or on the roof of a greenhouse, are better than pipes near the ground, where the dry heat comes into direct contact with the plants. The return pipes should come under the benches or stages, because these only give off a very mild heat. The overhead flow pipes counteract the cold air and keep the atmosphere moving, which is most essential.

It should be remembered that the cold always comes in from the outside, and not from the ground upwards, as some seem to imagine.

In a narrow house of from 10 to 20 feet in breadth, the flow pipes should be placed down the sides of the roof of the house to counteract any cold air which would drop downward from the roof.

The evaporation of heat is more nearly in proportion to the glass surface exposed than to the volume of air contained under that glass surface.

I have great faith in 3-inch pipes, because it is possible to get the heat more evenly distributed. Four-inch pipes carry such a bulk of water that once they become chilled it takes a considerable time to warm them up again, as compared with 3-inch pipes.

Experience has led to the favour of the section boiler in preference to all other patterns. They are a veritable heating engine, and in the hands of an able man can be regulated to a nicety. Yet we live in an age when all our knowledge regarding heating greenhouses is undergoing a change, particularly in the matter of boilers.

We may all look forward to the day when it will be possible to have a really inexpensive mechanical force to impel a quick and even circulation, and when $1\frac{1}{2}$ - or 2-inch hot-water pipes can be used, and the heat be thus perfectly distributed.

COMMERCIAL HOUSES FOR CARNATIONS

Ideas differ, and always will, regarding the perfect commercial house for growing carnations. Large, light, lofty houses are those most favoured by all the best commercial growers, because the culture can be more economically carried out. It is farming carnations under glass rather than horticulture, and broad lines can be followed in the matter of water and ventilation, while the problem of artificial heat is a much more simple one. I believe that a house 250 feet long and 50 feet broad is of sufficient dimensions to satisfy any reasonable grower, and when it gets beyond that it begins to be

a freak house. The eave plate should be 5 feet from the ground, which gives 3 feet glass side ventilators, 25 feet to the ridge. The ventilation should be as previously described. Such a house would have eight benches, and hold about 10,500 plants.

For growing the young carnation plants, and for propagating, I prefer small houses, 10 feet broad and 8 feet to the ridge, 4 feet to the eave plate, with 2 feet of glass down the sides and top, with side and bottom ventilation.

CHAPTER XVI

FLORAL VALUE OF CARNATION BLOOMS

THE reason why the arrangement of flowers can never be classed with the higher arts is because it is temporary.

A mere fragment of sculpture or canvas may lay claim to greatness because of its perfection, and may make the sculptor or artist immortal, because his name is upon it; but the florist may embody in the arrangement of a single vase of flowers the highest perfection of art and blending of colours which has been perfected through the experience of years, and yet like a fleeting sunset its charm vanishes and the memory of the florist is obliterated.

The florist has created many designs, but creations such as wreaths, baskets, sprays, table centrepieces, and so on, give us the best and highest ideals, and are to be preferred to the freak designs, such as clocks, motor-cars, etc. The value of a floral design or a vase of flowers should not so much depend upon the number of flowers employed as in the manner in which they are used.

Any flower, to be really popular, must possess many qualities, the first of which is beauty—a somewhat indefinable and elusive term. Others are scent and durability. The flower must also be so produced that it can be used in all the methods of the floral art. For instance, the Camellia's greatest weakness is its lack of stem. Some of our most beautiful Orchids also suffer from this defect; while lack of durability is the one shortcoming of the Rose. Lastly, the flower must be such that it can be cultivated commercially and profitably at prices which bring it within the reach of a large number of people.

The carnation fills all these requirements, and is the greatest staple commercial flower in existence, easily outdistancing the Orchid, Rose, and Chrysanthemum.

The best method of handling and preserving cut carnation blooms took the wholesale market growers years to find out. First one and then another system was followed, until at the present time all large growers are agreed on, and practise, the same method. I think it would be a distinct gain in the private establishment if some of the



A beautiful bouquet arranged
by Mr. R. F. Felton.



Carnations as packed
for sending to market.

wholesale grower's methods were practised—that is, when large quantities of blooms are wanted for one special occasion. Too often the flowers are cut and taken direct from the greenhouse into one of the rooms to do service without having been previously prepared for the ordeal.

All will realize how important a thing it is that the flowers should last well after being cut, so that all that is possible in the way of lasting capacity can be got out of them. Nothing is more appreciated by the recipient of a floral gift than that such a gift should remain fresh for at least fourteen days.

For flowers to last well after being cut, they must have been grown in a cool, normal temperature, as previously advised. They must have had a slow-acting organic carnation food. For instance, an unevenly balanced manure, with an excess of nitrogen, would cause a strong, sappy growth, and the flowers would not last for any length of time.

IN A COMMERCIAL ESTABLISHMENT

Carnation flowers are always cut in a three parts developed state. The flower is still in its youth, so that a slow development goes on for several days afterwards.

The flowers are not broken off at the joint, but are cut with a sharp knife, with a slanting cut, just above a joint, this being considered a matter of no small importance, as it has been proved that the stem takes the water up more readily when so cut. The cutting is done in the early morning, while the air is cool and laden with moisture. The flower and stem is more full of sap in these early hours than later. This view of the matter is quite common knowledge, and generally understood, yet it is too often neglected.

As soon as the flowers are cut in the early morning, they should be taken direct to the bloom shed, and not be left out of water more than a few minutes, so as not to allow the sap exuding from the cut to evaporate and dry, otherwise the means of conveying moisture to the flower will be shut off, and the result is that the bloom suffers. If once a carnation flower is allowed to wilt for want of moisture, it is spoilt.

Remove several of the lower leaves, and place two dozen blooms in each vase, not close together, but spread out, allowing them plenty of room, so that the outer petals do not touch. There should be space between the vases. The length of time a carnation bloom should remain in water in the dark room greatly depends upon the time

and season of the year—as a rule, six hours or less. Some varieties improve in water, becoming quite one-third larger, while others, owing to their hard, wiry stems, do not improve at all. Such matters are quickly learnt by the observant gardener.

The large cut-flower grower does not reserve his flowers for any special occasion by leaving them on the plant, but cuts them as they arrive at the correct condition for cutting, placing them in the flower-room, where they keep fresher and last better. Many people imagine that flowers cut direct from the plant are best, and last longer; but there is no comparison between these and a flower which has stood a few hours in a proper flower-room.

I venture to say that all the best blooms at our leading Carnation Shows, which carry off premier honours, have been cut from one to three days previous to the show, the water being repeatedly changed, and stems re-cut at least once every twenty-four hours.

Carnation blooms which are cut in the afternoon upon a hot, bright, windy day, cannot be expected to last long. If blooms are taken from a warm greenhouse and plunged into icy cold water, they are sure to be affected by the sudden change, and their life will be shortened; and if taken from a cool greenhouse and suddenly placed in a room with a warm, dry atmosphere they, in like manner, will feel the sudden change. Carnation flowers may also be injured by contaminated air and noxious gases. No flower enjoys a pure, cool, dry atmosphere more than the carnation. Few flowers last longer if handled in a practical and reasonable way, but if the plants or flowers are exposed to sudden extremes, it is unreasonable to expect the best results.

CARNATIONS FOR THE MARKET

The first and most essential condition towards the successful conducting of a commercial establishment is the bloom shed. This is always an important department where cut flowers are the staple commodity. A dark cellar or room which is free from outside climatic conditions, and stands at about 45 degrees, as an average, during the four seasons of the year, is almost ideal. Scrupulous cleanliness should be the keynote. The air should be pure and sweet. Large earthenware vases which hold a good body of water are greatly to be preferred. These must be thoroughly washed occasionally, and always kept perfectly clean and sweet. They should be of sufficient depth to allow the stems to be three parts submerged in water, which should be changed every twenty-

four hours. I have made excellent vases for this purpose by using glazed drain-pipes, and stopping them up at one end with cement. The flowers should not be allowed to hang their heads over the sides, but should stand up erect, otherwise the flow of sap is checked, or, in other words, the flower strangles itself.

When packing, think of the indifferent handling the goods will receive at the hands of the porters, etc. Pack firmly in a strong box, making perfectly sure that the flowers will not roll about. This is better than excuses and explanations, and will inspire more confidence for the wholesale trade. I use boxes 12 inches broad, 3 feet long, and 5 inches deep, with drop lids. These hold twenty-four flowers. For small retail supplies, boxes 18 inches long, 6 to 9 inches broad, and 5 inches in depth are used, and the flowers are tied to the bottom of the box.

In bright warm weather the boxes are thoroughly damped a few hours before being used, so that the wood will not extract moisture from the flowers. The boxes are all lined with a good white tissue paper.

Tight rolls of newspaper, a little over $\frac{1}{2}$ inch thick, are made, which fit tightly across the box, so that the calyx of the flower, when laid in the box, rests upon the roll, preventing the outer guard petals from touching the bottom of the box. Three blooms are placed in a row, and then a roll is placed for the second row of flowers. This also holds down firmly the first row of flowers, and so on for the two dozen blooms, the last row being finished off with a final roll. Afterwards a long strip of thin white paper is placed over the stems, and a bunch of damp wood-wool put upon it. Then the long end of the sheet of paper is brought back over the wood-wool. The stems are thus kept moist, and the wood-wool does not get mixed with the flowers. Flowers packed like this will keep fresh in the box for twenty-four hours, and always arrive in good condition, no matter how the boxes are knocked about.

The great art in packing flowers is to prevent them moving in the boxes, and so becoming bruised.

GRADING FLOWERS FOR MARKET

The grading of flowers for market is second only to packing. I put mine into three grades: specials, firsts, and bunched. In the case of specials, every flower is a perfect exhibition specimen upon a long and strong stem. The firsts are almost as perfect specimens, but slightly smaller and shorter stemmed; while the

bunched are composed of those which are not good enough for the two other groups. These are sold by the bunch of twelve blooms; but even in this lower grade every flower must be perfectly fresh.

THE TEMPERATURE OF WATER FOR CUT CARNATIONS

The temperature of the water in which to place cut carnations directly should never exceed that of the house from which the flowers were cut. For preference it should be a few degrees lower, but care must be taken not to give the flowers a sudden chill by putting the stems into water that is too cold, nor to go to the other extreme by using hot water. The idea is to get the water a few degrees higher than the temperature of the cold room, and a few degrees lower than that of the house. Thus, if the greenhouse were 52 and the cold room 48 degrees, the temperature of the water should be 50 degrees.

As water approaches its greatest density at about 41 degrees it should never be used near or below that point for storing carnations cut from the greenhouse. Some may think that I dwell too much on this matter, but a cut carnation is a very sensitive flower, and is quickly killed by water of too high or low a temperature, whereas, on the other hand, under correct conditions, it lasts for at least ten days.

CARNATIONS AS EXHIBITION FLOWERS

The Perpetual-flowering Carnation broke down those relics of the early Victorian era, the stiff paper collar and exhibition board so dear to the heart of the Border Carnation Specialists; and it has done more, perhaps, to revolutionize flower shows than any other flower. The straight benches, with banks of flowers, are dying fast.

I always work to a plan, and, to a certain extent, have my own original ideas. I aim at filling tall specimen vases with some three to four dozen flowers standing alone, and every flower must be perfect. In order to preserve the individuality of these flowers small 6- to 12-inch vases stand in between them. I avoid making a bank of flowers as much as possible, and place every vase so that it plays its part, and can be seen with ease. In arranging the flowers in the vases I cling as closely as possible to the natural habit of the flower, trying to preserve elegance and individual beauty, and using the natural foliage and buds.



A Carnation exhibit of merit.



Perpetual Carnations grown
for cut flowers at Messrs.
Englemann's nursery.

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One of the large commercial houses
at Messrs. Lowe & Shawyers.

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CUT CARNATIONS IN THE HOME

As a home flower the carnation should always have its stems left long, thus preserving its natural elegance, and it should never be crowded. A tall, slender vase is undoubtedly the best receptacle for it. In arranging all flowers, try to imitate Nature as closely as possible. Some flowers should only be looked down upon, others only looked up to, but the carnation is beautiful from any point of view. Contrary to the general rule, carnation flowers will intermix with other smaller flowers, and still look beautiful, and also with fern and foliage.

It is most difficult to intermix pink shades, and rose pinks should never be near salmon pinks. Many similar contrasts will be equally unpleasant to the artistic eye.

Carnation flowers decorating a room, in vases, should be supplied with fresh water each night, and be removed to a cool cellar or similar place free from draughts. The stems should always be cut previous to placing in water, and at least every second day afterwards. Never use scissors or break the stem, but make a slanting cut with a sharp knife. I have found that adding a little soda to the water helps to keep the flowers fresh longer, and a lump of charcoal helps to keep the water sweet in hot weather.

CHAPTER XVII

COMMERCIAL CARNATION BLOOM PRODUCTION

UNDOUBTEDLY many private establishments would be well advised to follow the wholesale methods used by commercial carnation growers, so as to obtain the maximum quantity of bloom with the minimum cost. There are two popular systems, British and American. It must be clearly understood that only a few varieties of Perpetual-flowering Carnations can be grown profitably for commercial cut blooms.

For matters of propagation and growing the young stock, see Chapter II.

AMERICAN METHODS

The American method of cultivation, put in a nutshell, is simply this: plant young stock out of doors in early spring, and lift and replant in the greenhouse in the late summer. The entire system is built upon putting the plants out on benches (stages) or out of doors. Many nurseries in the United States do not have a flower-pot in the establishment.

This seems very simple and easy, but the primary points which apparently cause the difficulties of this method in Great Britain are the lateness at which it is necessary to plant out young stock in order to be free from late frosts, coupled with very indifferent spring weather and the early lifting and benching of the plants, owing to the dull British winter, which a plant cannot withstand unless it is well established. So between late planting and essentially early lifting the growing season is somewhat curtailed. With these drawbacks and with a cold, wet summer, the case of the carnation in the field is hopeless.

You can hoe and counteract drought, but you cannot by any known means make carnations do well in a wet, cold, English summer. You cannot speculate with a valuable carnation crop and the chance of empty houses.

I have met men who grow their carnations on the American

system over here and speak highly of it, but allowances must be made for the various degrees of success with which some are content: few nurserymen know what their products cost them to produce. They cannot, for certain, even tell which is their most profitable crop or variety.

It does not require a labyrinth of figures to discover at which season of the year flowers pay best. This is why it is necessary to have a modified system to suit the English climate.

ENTIRE BRITISH SYSTEM OF GREENHOUSE CULTIVATION

The bulk of all stock is grown under the system known as "entire greenhouse cultivation"—that is, the plants never leave the greenhouse. Certain varieties give much better results, producing finer flowers, and a cleaner, healthier stock when grown this way. It is the most expensive system, because the young stock has to be potted on into 3- or 4-inch pots, and have the best attention, so as not to receive a check, until they are planted out on the benches from March to June. Naturally the summer cultivation is very expensive, owing to the large amount of attention required; in fact, without very well-constructed houses, with an abundance of ventilation, and a powerful watering system, failure is certain. Such famous commercial carnation cut-flower growers as Mr. Wallace of Eaton Bray, and Messrs. Lowe and Shawyer of Uxbridge, keep their plants healthy under glass for from three to four years.

Be sure the plants are in the right condition of moisture when they are being planted. To plant one with a dry ball is worse than potting one dry, because if a plant is found to be very dry in a pot, it can be soaked in a pail, but it would be a difficult matter to soak a bench enough to get a dry ball soaked, and then dry out the bench sufficiently before the plants were spoiled.

The best time to water freshly planted young stock is before the sun is on them. If they have been well planted, it will be possible to see every ball, and the dry ones will look dry. If left till the sun is on them, all will look dry.

When the plants have been planted about three weeks, the bench should need a thorough watering all over. Do not be afraid of the water running right through, as it is much better to lose a little water than only to half-water the bench. After this watering, the bench should have a good watering every seven or eight days. I do not believe in only watering the dry spots, because in this way one can never keep the bench under proper control. When I water a bench

I go over the dry spots and water them, and then I turn full force on the hose and water the entire stock.

Always remember when watering that it is easier to water a bench than it is to get it dried out. Be sure and not let the bench get too dry, and dig into the soil occasionally so as to find out how much moisture is in the soil below the surface.

For carnation greenhouses, see Chapter XV.

STOPPING

After what has been written regarding stopping in Chapter V., it is unnecessary for me to enlarge upon it, except to endorse rules laid down; that the plants must be gone over each week, and not more than one growth stopped upon a plant at a time. This breaks up the cropping tendency. I stop right up to August.

The art of stopping Perpetual Carnations so as to obtain the best results during the winter months is not learnt in one season by experience or picked up too readily by reading about it. Circumstances, such as varieties and latitudes, alter cases; and it is in these matters that the grower must exercise his own judgment.

The first thing to decide is when the main crop of bloom will be required and work accordingly, but those who grow carnations for a living will want to start cutting in late September with no cessation until June, having particularly heavy cuts at Christmas and Easter. The exact way to achieve these things is not easily determined. Whilst it may seem an easy task when figured out on paper, it is much harder to carry out in practice, as some of the old growers who were growing the carnation in the days when Miss Lizzie McGowan and William Scott were considered the limit of productiveness will know. Yet there is one thing about the Perpetual Carnations which is wonderfully consoling to the man who is starting to grow them, and that is that, no matter at what time he stops his plants, he is sure of his crop of bloom under anything like normal conditions.

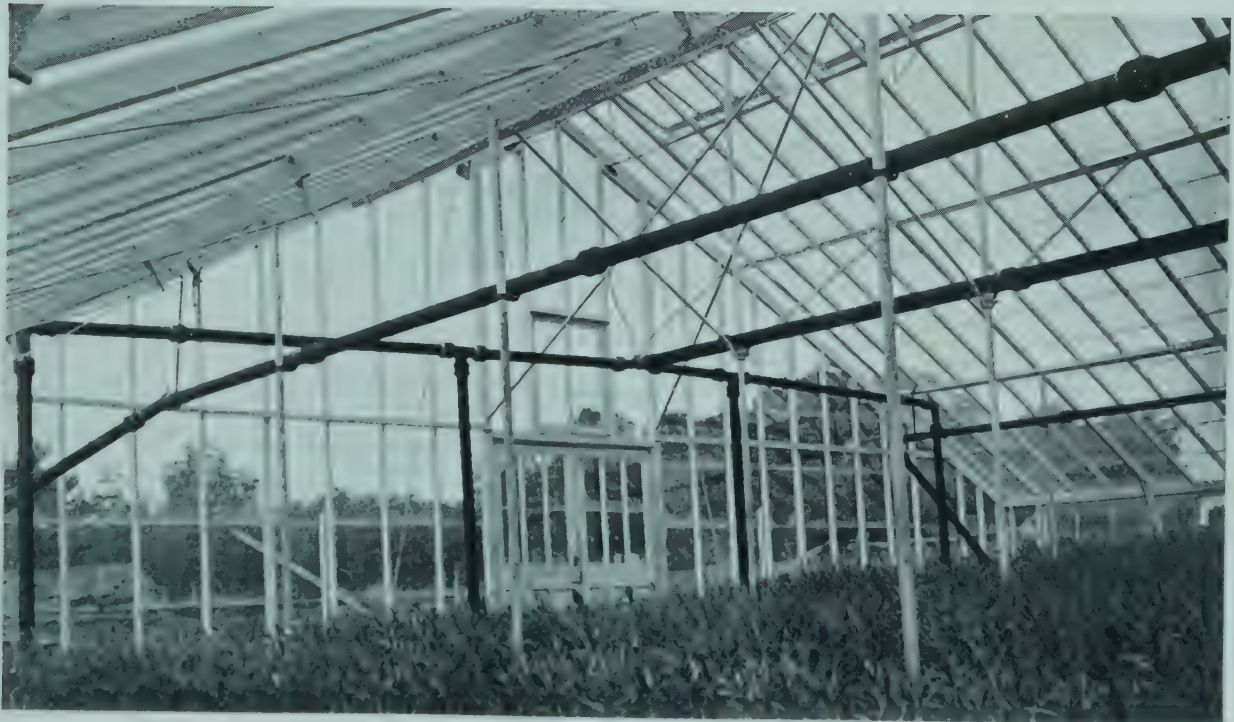
SOIL FOR BENCHES

The foundation of all culture is soil, although the carnation will do well in many kinds of soils. The best soil for bench work is, however, a medium loam, one that could not be termed a light or heavy soil, with a good proportion of sand in its make-up, yet at the same time possessing a fair amount of moisture-holding humus. This should come from a turf field for preference, although I have



Filling benches with compost in a commercial house.

84



The modern method of overhead heating.

85



Commercial Carnation houses are planned so that they receive the maximum amount of light and air.

86



One of Messrs. Allwood Bros.' Carnation houses at Wivelsfield Nurseries.

87



A commercial house has ample top and side ventilation.

88

seen some of the best carnations grown on soil cut from a red clover field. I like to plough my turf off the grass field in the early autumn, where it lies rough all the winter, and harvest it in the early spring, when I mix as advised in Chapter III.

BENCHES

An American bench is what is known here as a stage. There is a great variety of styles, but board, concrete, and tile benches are the principal ones. No bench should have more than 9 inches deep of soil, and never be more than $4\frac{1}{2}$ feet broad, or higher than 2 feet from the ground, which is conveniently high for working.

The tile benches are built in innumerable ways, some with iron supports and cement sides, others entirely of cement with a tile bottom (which is the main point), whilst the pure cement bench is built in sections, the bottom and sides being of cement; but it is not necessary to describe these here. In a well-drained situation two boards fixed $3\frac{1}{2}$ feet apart make an ideal bench; other growers have chalk or clinker placed at the bottom for drainage, which is the all-important point.

Filling the benches is one of the heaviest duties which falls to the lot of a horticulturist, for it is done in the hottest season of the year, and must be carried out with a rush. One assumes that the soil has previously been prepared as advised in Chapter III., always making quite sure that it is in a perfectly correct condition. The way to place soil properly on the bench is to tip it out of the barrow in a heap in the centre of the bench. This allows most of the lumps to roll to the bottom, and the man who is levelling out the soil will work the rest down, so that it is firm for planting.

PLANTING IN THE HOUSES

Plant according to varieties and sizes, from 8 to 12 inches apart, and firm the soil well round them, placing the smaller plants on the south side of the bench, because, as a rule, they grow better in that position. Also take care not to plant any deeper than the plants were in the small pots.

I want to impress upon my readers that it is most important to have the bench properly lined out before commencing to plant. The best way to achieve this is to have a nail in each side of the bench where the rows are to come, and then stretch a thin piece of string across for each row. This enables the planters to plant the four or five rows across the bench together.

I usually have two planters to a bench, one on each side. The point to be watched is not to make a deep, narrow hole, but a shallow, saucer-shaped one, leaving a slight depression round the base of the plant for early waterings.

Ventilation should be sparing for the first week after planting. Try to keep a moderately moist atmosphere, and avoid drying draughts. Give a gentle overhead spray each day, just sufficient to freshen up the foliage, but no heavy wetting of the soil should be done until root action has recommenced; and all foliage must be dry by night. This is readily seen, for with this system the foliage straightens up and becomes plump.

After the plants have been planted a fortnight, there is one thing that will be perfectly sure to appear, and that is, a crop of weeds. These must be dealt with as soon as they are seen.

An experienced grower knows from the look of a plant whether it requires water or not. In the bright, sunny weather, the soil will dry from the top, and in dull weather, when fire-heat is used, from the bottom. That is why great care and judgment must be exercised in watering carnations in benches.

I am a great believer in the watering by hose-pipe, if it is in the hands of an intelligent grower. It is the rarest thing for me to be troubled by any pests, simply because I can spray my plants upon bright days with a high-pressure water system, which distributes the water like a Scotch mist.

SUPPORTING

As soon as the plants have established themselves, it is necessary that they should be supported, otherwise the plants fall over, are partly spoilt, and the labour takes double as long. There are several ways of supporting plants growing on benches. Using 9-inch stakes and raffia for the first tie, wire supports for the second, and wire and string to form a network to support the plants are exclusively used. In the last method wires are stretched tightly down between each row of plants and outside the two outer rows. The wires are attached to a framework at each end of the bench, and laths are placed across the benches at every ten or twelve feet to bear the weight of the wire and also to regulate the distance between the wires. Then twine is used for cross-tying, a double row 2 inches apart between each row of plants, so that it is held in a square, the twine being wrapped round each wire once. This will require four ties of wire and string for each bench of plants. Patent wire plant supports are often used; this fixes on to a thin stick placed near the

base of the plant; above this is a network of wire and string, as previously described. The advantage of this system is that it is quicker, and, the supports being adjustable, the individuality of the plant is preserved, and the growth has more light and air.

CULTIVATING THE BEDS

The surface soil will require cultivating from time to time, so that it does not become packed and hard, and also to ensure the weeds being kept in check. This cultivation must not be deep, or the feeding roots of the plant which extend to the surface will be injured; but if the surface soil is kept loose, the air can act upon the entire body of the soil better.

DISBUDDING

This has been fully described in earlier chapters, and calls for no additional words of mine, except again to endorse the importance of not neglecting this matter. This particularly applies to market growers, because the amateur, as a rule, is too anxious about dis-budding, and does it too early.

For attention of plants during the summer and winter, refer to Chapters VI. and VII.

For handling the cut flowers and marketing, see Chapter XVI.

CHAPTER XVIII

RAISING CARNATIONS FROM SEED

WHEN TO FERTILIZE

FROM March to early July is the best season for cross-fertilizing carnations, because the plants are then at the height of their vigour, and the seedlings themselves will have much greater vitality; whereas in midsummer the growth is not nearly so vigorous, and the seedlings lack stamina. On special occasions, however, in a favourable autumn when I have had occasion to fertilize, I have found that little, if any, difference from the early spring season occurred, provided I was able to ripen the seed well. This latter is in itself a most important factor.

I have repeatedly noticed that crosses made in the winter produce more singles and fewer split calyxes, whilst crosses made in March, before heavy feeding commences, produce a very nearly equal quantity of singles and split calyxes, with three times as many seedlings of what I will call commercial forms, as the total of the other two. In late summer crosses I have noticed an increase of split calyxes over the singles. The above cannot be taken entirely as conclusive, but I think it is sufficient proof that early spring is the best season.

During the late summer vital pollen can be had in abundance, and the reproductive organs of the seed bearers are most eager to receive it. But this only proves what is well known to everyone conversant with the workings of Nature—namely, that she ever makes her greatest efforts at perpetuation at the last stages of the life of the plant. In short, it shows that carnations, like all else, when most anxious to bear seeds, are beyond their prime, and almost at the end of their career. That is why late summer fertilizing and the using of old plants as seed parents, with few exceptions, prove a failure.

PARENTS

The selection of the parent plants is a most important matter in raising carnations, and much depends upon their environment and condition at the time of fertilization. Varieties showing any

hereditary tendencies towards disease must be avoided. Often these will have some good quality which one is anxious to use, but I can say that I have never used as a parent any seedling with a tendency towards disease without regretting it, although perhaps it has been four years after. The plant, as well as the individual flower, must be a perfect specimen.

The pollen-laden anthers should be removed from the seed-bearing flower as early as possible before the pollen is liberated.

The pistils are mature within a few days after emasculation.

FERTILIZATION

Fertilization is the union between an egg and a sperm, or the fusion of the male and female elements produced by the flowers. Pollination is the term used to indicate the transference of pollen to the stigma. This may be performed by natural circumstances, such as insects or wind; but with highly-developed flowers, like the modern carnation, it must be performed artificially to obtain the best results.

Artificial pollination itself is simple, and can be easily carried out. The principal point is to have the stigma of the flower in the proper condition. This is readily known to an expert; and a novice, with a little observation, will quickly learn. A small microscope is of assistance. Tiny, hair-like growths, standing out along the entire length of the upper surface of the stigma, will be noticed. When these hair-like growths are well developed, and especially when they assume a transparent appearance, and seem to be covered with tiny dewdrops, the stigma is ripe for pollination.

The operation should be done just as soon as the pistil is in condition, great care being taken that the pollen, which is produced upon the anthers, is also in the right condition. As the anthers burst—which is, as a rule, during the late morning or about noon—they discharge a fine powder. This is the pollen, and it is in perfect condition a few minutes after being discharged, if the atmosphere is dry. But if it is desired to keep it for a few days, to wait until another flower is in condition, this can be done by placing it in a small glass with an air-tight stopper. The pollen, however, will remain in condition for two days in a dry atmosphere if left upon the flower, but it is always best, when possible, to use it as soon as it has been discharged. In fact, I have, in recent years, noticed that few good results are obtained where old pollen has been used, and I strongly favour using perfectly fresh pollen only.

I have found that the best instrument to use to transfer pollen

from the anthers to the stigma is a small piece of blotting-paper, about $1\frac{1}{2}$ inches long, tapering from $\frac{1}{2}$ inch down to $\frac{1}{16}$ inch. This thin end should not be cut off, but pulled, so that it forms a minute brush. A fresh piece of blotting-paper should be used for every cross. With this little device not a grain of pollen need be wasted, and enough can be obtained from a single anther to pollinate a flower, and in some of the new large-flowered varieties, where pollen is exceedingly scarce, this is a great consideration.

Among other instruments which are used are small camel-hair brushes, but the danger of foreign pollen being in the brush is very great, unless several are used, or the brush is sterilized. Some take the pollen-laden anther between the finger-nails or tweezers, and touch the stigma of the pistil with the brush. It matters but little in what way the operation is performed, so long as the desired result is attained. The hours between eleven and one are the best for the operation, selecting a bright day.

If the pistil of a carnation is examined, it will be noticed that the stigmas all lean one way, almost in the same manner as the hair upon a cat. Thus, if we rub these at all heavily in the wrong way when pollinating a flower, we bruise them and spoil the flower, and also waste time. Again, it is quite easy to place too much pollen upon the stigmas, and literally choke them, causing them to decay. Think of the soft, silky coat of the bee, and endeavour to imitate it.

Great care must be taken of the seed-bearing parent, to ensure its perfect health, as this has a great influence upon the result, as also has the state of the weather while the seed is ripening. To aid this we tear down the calyx to let out the moisture, and remove the petals as soon as they become quite withered. When the ovary is fully swollen, remove the calyx entirely, so as to allow the sun and air to have full action upon it.

As a rule, about two months is sufficient for the seed to become fully ripened. This is easily recognized by the pod turning brown at the top. Pick it off with a few inches of stem, and put it in the full sun, or in a dry, airy place for a few days. Afterwards take the seed from the pod, keeping it in a cool, dry place, fully labelled with the cross, time of pollination, and date when collected.

SELECTION OF SEED

The most important step is to obtain the best seed procurable, whether bought from a specialist, or home-saved, because it will be seen that this plays the principal part, otherwise valuable time,

room, labour, money, and interest will be wasted in fondling seedlings predestined to fail. The principal aim in view should certainly be to raise a seedling of excellence, coming as near as possible to perfection in all respects.

From all seed there will be a certain proportion of singles, those which split their calyxes and croppers, yet the percentage of these depends purely upon the quality of the seed and the amount of care bestowed upon its production; also, seed of an inferior strain like Marguerite Carnations, etc., germinates and grows more readily than that from choice kinds.

SOWING THE SEED

The seed of carnations can be sown at any season of the year, with very similar results; but as early in the year as possible is the best. The main reason for this is that the seedlings grow with the spring season, and they thus have a favourable start in life; also all the seedlings of any value of the Perpetual types will have developed their first bloom by September. The inferior seedlings can then be discarded before the winter, whilst those of promise of greenhouse strain will produce their second crop of flowers early in the New Year under glass.

Sow the seed in shallow boxes or pans. I almost half-fill a 5- or 7-inch pan (according to the quantity of seed in the pod), so that each seed pod has a separate pan to itself which can be labelled with the cross made or the number of the same. Use a fine, light, sandy soil of pure loam and sand in which to sow the seed, making up the pot or boxes, as the case may be, to within $\frac{1}{2}$ inch of the top, and see that the soil is reasonably firm.

Sow the seed thinly, and cover it with never more than $\frac{1}{16}$ inch of soil. Through a fine rose allow sufficient water to reach the bottom of the pan. Place it in a position where it can receive a bottom temperature of 60 degrees if in the winter, covering the whole with a sheet of glass, so as to keep away mice or insects. If there is the slightest risk of the soil not being perfectly clear of wireworms, etc., sterilize it before using.

The seed will take from a week to ten days to germinate.

As soon as the seedlings commence to appear, remove the paper, but leave the glass over for another day or so. Place the pans in a lighter and cooler place to assist the young plants to grow stiff and sturdy.

All seedlings are difficult to handle, and young carnations are

no exception to this rule, and require great care in the early stages. If they are clumsily sown and come up too thickly, or are improperly watered or aired, they damp off.

If exposed to strong sun, they wither; if too heavily shaded, they grow weakly. In the early life of a seedling it should never be allowed to become dry.

As soon as the true sets of leaves are almost fully developed, the seedlings should be pricked out at from $1\frac{1}{2}$ to 2 inches apart into other boxes or pans, using a compost as for the seeds, but with not quite so much sand, and a small quantity of wood ashes added. Great care should be taken in the operation not to bruise the root. Place each seedling in the soil up to the seed leaves. Water well with a very fine rose, and keep shaded and close for three days, and afterwards give the same treatment as that afforded to the ordinary growing young stock being planted out of doors, etc.

I do not pick off seedling Perpetual-flowering Carnations and Malmaisons at all, but pot them off into 2-inch pots instead, and I only lose an odd one or two in as many thousand seedlings. My reason for doing this is that a seedling makes an abundance of roots, which are often broken when potted off in the ordinary way. A seedling should receive the best possible treatment, so that if a new variety is obtained, it will not carry any traces of neglect or carelessness received in its early stages.

From this stage the young plants should be treated as advised in earlier chapters, potting them on as required, until they reach a 6-inch size pot, which is quite large enough for a seedling in its first year. A smaller pot than this would check the development of a very vigorous seedling.

It is possible to bed out seedling Perpetual-flowering Carnations in the spring and procure blooms in the late summer; in fact, some large growers test their seedlings this way for the first time, lifting and potting those of merit.

I never stop seedlings, but allow them to grow direct to flower, so that I can weed out the singles and useless ones as early as possible, and give those of promise full attention. I disbud and support the seedlings precisely as I do the standard varieties, and as the flowers open I deliver judgment upon them and write the report. Those to be retained have their bloom cut, and are grown on for further test.

The closest registration should be kept of parentage, the time of first flowering, etc. The selection of those for further test calls for great judgment. They should be flowered for the second time, notes being made of their freedom of growth, how the flowers develop, etc..



The four stages of a flower
from fertilization to the pro-
duction of the seed pod.

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- (1) Pot of Seedling Carnations.
- (2) Seedling transplanted in a 2-inch pot.
- (3) Seedling potted on into 3-inch pot.

90



Perpetual - flowering
Carnation seedlings.

91



1

2

3

4

Nos. 1 and 4 illustrate the best type of bud and calyx for breeding purposes; Nos. 2 and 3 show the worst type of bud. Note the lack of spring in the calyx claws and the narrowness in the basal bracts, the progeny of split calyx.

92

every two months. Those which come through this test should have some six or more of the best and strongest cuttings taken and rooted. These should be watched carefully, and given the best cultivation during the second year's test. Any that pass successfully through this stage should be grown for cut flower or general purposes, the stock being worked up gradually.

SELECTION OF SEEDLINGS

By selection of cuttings, a variety of seedlings may be raised to a much higher standard of excellency. Until they have been grown for three or four years, and propagated from, it is not possible to know exactly what they will develop into, and the treatment they receive during that time, and the district they are grown in, play a far greater part in their future development than is at present recognized. I have known a seedling to change its colour completely during the second year of trial.

Thoroughly good cultivation and selection of cuttings will improve such parts as the stem and calyx. Young carnations, like children, can be improved or spoilt according to their environment.

In selecting the seedlings to grow on for further test, be guided by solid facts, which are devoid of sentiment, because it is only the former at which a buyer of new carnations will look. A seedling carnation must be a right out-and-out, all-round, perfect specimen, and not only look but be good.

There is a possibility, among thousands of worthless seedlings, of securing one distinctly new, and to all appearances vastly superior, to any now under cultivation; therefore, in spite of all discouragements to be met with, there is nothing in the world of horticultural exploits so alluringly captivating or so vividly interesting as the raising of carnations from seed. If you do not get a new improved kind, you will obtain many beautiful plants at a small cost.

CHAPTER XIX

THE RAISING OF NEW VARIETIES OF CARNATIONS

THE raising of new varieties is perhaps the most interesting and absorbing of any function connected with flowers. The great uncertainty of it seems to have a particular fascination.

It is only the enthusiast who would dream of undertaking such a work as the improvement of the present-day carnation. Whatever success he may meet with, many years will pass before he himself will benefit, and from a remunerative point of view, his chances of gain are small. So let no one be lured to raising carnation seedlings purely with the hope of gain, but rather be inspired by the earnest desire to do some good, honest work in the improving of the flower so much admired.

At present size and colour count for much, simply because such qualities are better rewarded and more readily recognized at shows. Scent, productiveness, and robustness of constitution are points not so readily observed, and seldom rewarded, yet they are equally as important, and every bit as difficult to obtain.

The hybridist may work for years to regain the scent of the old clove in the modern carnation, only to have his success ignored by an indifferent committee and an unappreciative public. Years later his labours may become recognized, but as his name cannot be on the perfume, he loses his reward.

I strongly oppose any laws being laid down by any society or central body to which the raiser of new varieties has to work in the matter of shape or build of the flower or petal, colour, markings, etc., the same as I dread the thought of all pictures being painted after the same fashion. I maintain that so long as the variety has a free, healthy habit of growth, the other details are for the public to decide, submitting, of course, that such essentials as strong stem and calyx, lasting qualities, etc., are conformed with. Beautiful flowers are what is wanted, no matter if the shape of the petals or markings do not conform to the florists' rule.

To meet with any measure of success in raising seedling carnations, each cross must be done with some definite object. There should be

a reason for making the cross, and the operator himself should also have an idea at which to aim. He should have his model carnation ever fixed prominently before him, and be able to some extent to predict the results.

We all have our own definite system, and follow out certain rules or ideas. I give here a few rules which I have found to be of the greatest benefit:

Never use any plant for pollen or seed bearing unless it is in the best possible health, and free from all taint of disease.

Never use for breeding purposes any seedling under a year old, simply because enough cannot possibly be known about it.

Only varieties with a free, quick habit of growth should be used.

Exclude as seed bearers all varieties with yellowish-green foliage, only using those of the deep bluish-green foliage, as they, without exception, are the best parents, resisting disease more easily.

Every cross which is made should be registered, with the fullest details and data of both parents. An account should be kept of the percentage of singles and splitters, their colours, etc., so that it is not only known what the seedlings are that are saved for further test, but the predominating colour in the blood from which they are obtained. Keep an account also of all matters such as stem, calyx, freedom of growth, etc.

It is necessary to know something of the flower's primitive characteristics to understand the significance of its development. The more one studies the carnation of to-day, the more evident it is that the original carnation was of a vulgar pink, with a strong magenta shade, because, in spite of our efforts, a trace of magenta may be found in most of the present-day varieties. It is also known that the early carnation only bloomed in the spring of each year, and had a very grassy growth. In the present methods of cross-breeding, one of the greatest difficulties to contend with is the elimination of many of the objectionable characteristics which belong to the primitive form, and which cling very tenaciously to the race; whilst, in addition to these, there are other characteristics incorporated during later stages of development, which must also be eliminated, and it is the perpetual battling against these undesirable habits that retards the work and makes progress slow.

The tendency to revert is very great. Careful selection in breeding and good cultivation helps to eliminate undesirable

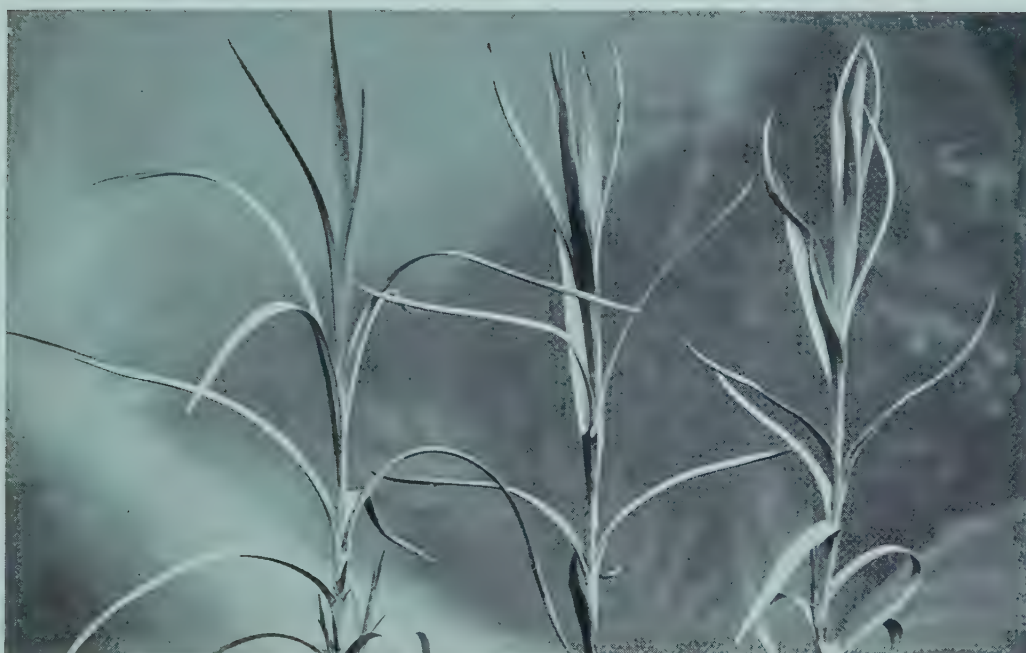
characteristics, but once neglect these all-powerful factors, and reversion is encouraged. The natural laws of reproduction are too strong for all the objectionable hereditary traits to be eliminated at once. The various characteristics of the different stocks or varieties are most noticeable, and after an absence of years an old weakness which was developed in earlier generations will reappear.

One of the greatest difficulties to be contended with is to get absolute purity of colour. The mauve, purple, magenta, and cerise shades are perpetually appearing, spoiling years of work, yet annually I note in the strain of seedlings a decrease in singles, weak stems, and split calyxes, so that the benefits of early labours are commencing to be reaped.

I put constitution and freedom of flowering first; perfume I look upon as absolutely essential; strength of stem and calyx third; colour next, and size last. My aim has always been to build upon a free-flowering, robust constitution.

It is the fine, almost instinctive, power for the perception of minute variations upon which success largely depends, and the lack of it in any case means failure. In other words, whether you are trying to improve the type of a race horse, carnation, or pigeon, it is a matter of judgment. This same power of minute observation enables a specialist to become acquainted, as it were, with his subjects, to learn their individual potency and combining powers, and, if he is careful about introducing foreign blood, to predict year by year more and more closely the result of his crosses. Yet he will often be unable to give any good and sufficient reason why he selected or rejected this or that seedling, or why he makes or avoids certain crosses, any more than the artist can give a rule or reason for all the varying form and colour in his masterpiece. Whatever result may be striven for, success seldom comes at first. It may come in the second or third year, or perhaps after many years of hard, intelligent work we discover we are on the wrong track.

It is often necessary to engage in preliminary work for years previous to coming actually to the object of our labours. If, for instance, it is wished to combine the four good qualities of four distinct stocks in one plant—the quick-growing habit of one stock with the perfect stem of a second, coupled with the calyx of a third, and the form of flower of a fourth—this would take several years to do. First, we must endeavour by intercrossing to combine the habit of growth and perfect stem of the two separate plants into one plant, and the calyx and perfect form of flower of the two other separate plants into one plant also; then bring the two separate groups together,



The light green straight habit of a leaf growth found in Carnations which never produce desirable offspring.

93



The type of growth from Carnations of good habit and constitution. Such plants make the best parents.

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Some of the newer varieties
of *Dianthus Allwoodii*.

and hope for the required result. Breeding for habit I have always found fairly easy to achieve. Build of flower, stem, and calyx are also not difficult to obtain in time.

STRAIN

The hardest task which falls to the cross-fertilizer is to purge any certain strain of stock from disease. Given a perfect strain of pink blood, which it is felt must eventually develop a phenomenal seedling, but which has a strong tendency to some hereditary disease coupled with it, past experience shows that it is absolutely impossible to purge it permanently of the taint, because it is passed on by the male and female parent alike; and whilst it may disappear for perhaps three generations, it is there, and is only waiting for a weak member wherein to reveal itself again. Undoubtedly, the best and cheapest way is to discard the entire strain.

There is one fact upon which I lay great importance, and through which all the best results have been obtained, and that is to plan out the most important crosses months before they are actually made. By keeping an accurate account of all seedlings which have flowered, I can tell almost exactly what certain strains contain, whether it is visible in the actual seedling or not, and in this I believe lies the secret of success, because the cross is planned more in cold blood without the influence of tempting seedlings or hurried work. It is proof of the fact that "blood will tell," just as much in carnations as in human beings or animals.

In developing scent, which is perhaps the greatest charm of the carnation, it has been found that by strictly adhering to the Mendelian law, this can be developed—or, shall I say, regained—with almost unerring certainty, but, of course, the greatest possible care must be taken in the work to keep the blood pure.

To fix a type I make four distinct crosses, as a rule. For instance, I commence with a seedling possessing at least some of the qualities aimed at, and (1) this seedling is crossed with its male parent; (2) the seedling is crossed with its female parent; (3) the male parent is crossed with the seedling; (4) the female parent is crossed with the seedling.

As soon as I am able to form an opinion of the results of this interbreeding, I again select offspring most closely approaching the ideal, and again interbreed. This illustration will give you some little idea of how the work is approached, and it also proves the absolute necessity of most careful registration of all results, so as to have a perfect knowledge of each strain or family group.

As a result of the high state of breeding to which the modern carnation has been developed, certain lines of work are often terminated by the production of varieties which are entirely sterile, producing neither pollen nor seed. Some varieties will produce pollen freely, but no seed, and others *vice versa*.

I have often found, in making reciprocal or reversed crosses, that when a certain cross does not set seed, owing to one of the parents being nearly sterile, by reversing the cross it will prove fertile. I first made these crosses mainly to prove which parent was prepotent in regard to colour of the flower and the habit of the plant. But my observations have led me to believe that either parent may have this quality. This, of course, is contrary to the common law that the pollen parent affects the colour, and the seed parent the habit.

CROSSES WITH SINGLE FLOWERS

There is a great difference of opinion amongst experts regarding the crossing of double, splitting carnation seedlings with single-flowered seedlings. My experience in this matter is that, in the first generation, provided doubles and singles from good blood have been used, we get almost 80 per cent. of what we might call standard doubles; if we recross these standard doubles, we get a large percentage of double splitters and singles; and if we carry the interbreeding on still further, so the percentage of the standard doubles decreases. But, at the same time, it is possible to procure some wonderfully fine seedlings by this process, and I often use it when trying to develop some good character or shade of colour, particularly in the case of a free, quick habit of growth.

HABIT

The importance of a good habit is obvious, because no variety can be of real value without it. Under this heading I group type, freedom and robustness of growth, and strength and length of stem. In the present day a variety of Perpetual-flowering Carnation that has not a free or quick growth is outclassed, because the more it can be stopped or pinched back during the summer, naturally the more shoots and, afterwards, bloom it will produce. So that a variety that can be stopped until the end of August or middle of September is far more profitable to grow, as a rule, than one that we dare not stop nor pinch back after the middle of June for fear of missing the winter crop.



Carnations flourishing in a London Park.



Ideal form in the Perpetual-
flowering Carnation.

There are many styles of growth. There is the long, loose habit, which does not produce many, if any, side growths until after the flower is cut; and, again, there is the free, branching habit of growth, which produces cuttings ready to be taken off when the shoot is in flower. These are produced near the base, hence the plant is always compact and shapely, as we see in the Perpetual Border Carnation; there is no doubt that this is the style or habit which will find most friends in all races.

The importance of length and strength of stem cannot be easily over-estimated in the case of cut-flower kinds. One is of little use without the other. I am inclined to think that the desired length for all decorative purposes has already been reached. Yet if we continue this increasing of the size of the flowers, so must the length and strength of the stem be increased. The large sunflower would not be so admired if it grew only a foot high. But with the increase in robustness of growth, all these things are made possible; the point is, the plant should be developed for indoor or outdoor cultivation.

Some of the modern varieties have stems so hard and wiry that they will only last a very short time in water, owing to the fact that the water cannot be taken up freely by the flower. This is a very great fault. In habit, formation of flower, calyx, etc., the female parent predominates.

SCENT

Carnations, perhaps, owe their popularity more to their enchanting perfume than to any other of their commanding qualities. It was the clove scent which caused them to be popular in the reign of Charles II.

If this is so—and undoubtedly the carnation has won its present high position mainly owing to its scent—it must retain it in order to maintain its position as a leading flower, for once the natural endowment is lost, the carnation will at once drop in the social scale of the floral kingdom, even if it possesses every possible shade of colour.

It is natural for carnations to have scent, so that breeding to maintain and develop this characteristic is not so difficult an object to achieve if one simply aims for scent alone. I am convinced that we shall shortly only recognize strongly perfumed varieties. It was this one point which the British hybridists lost in the early carnation, in their scramble for a smooth-edged petal and other attractions which they deemed in ignorance of more importance.

CALYX

If we add to the size of the flower and the number of petals, our task will not be fully completed if we do not also add to the size of the calyx, so that it conveniently holds the additional petals. No one would think of calling a split carnation a perfect flower. From the illustration (Fig. 99) the difference in the build of the calyx will be readily noticed.

Some are much larger at the basal bracts, others gradually taper from this point to the top of the calyx. Some varieties have an almost straight calyx, but the calyx claws are so formed that they act as a sort of spring, and it does not need an expert to recognize which is the better of the two. Many varieties have calyxes which are perfectly sound during bright, sunny weather, but split in dull weather. This is simply because the calyx is not in proportion to the other parts of the flower, hence it cannot hold during a slow, irregular growing period, if treated with irregular attention. Such varieties rarely enter into commerce.

Although the claims of a broad basal bract and a good calyx should be carefully considered in breeding, the matter of great importance is how the flower grows inside the calyx. It should grow regularly, and the petals should be clear of the calyx before developing.

In breeding I group stem and calyx, and aim for a strong, elegant stem, which will hold the flower erect, and not a thick fleshy one. It will be found that flowers inclined to be semi-double, which have come from parents possessing good stems and calyxes, will, as a rule, reproduce these qualities.

SUBSTANCE

Substance is yet another important factor in the ideal flower, for without this the colour will fade, and it is this alone which gives that most important quality, lasting capacity, which is absolutely indispensable.

As a rule, the worst build in a carnation for travelling or lasting qualities is the fine, symmetrically formed flower, with smooth-edged or shell-shaped petals. For good, lasting qualities there must be plenty of tissue in the petal. The unshapely petal with a rib in it lasts much better as a rule than a flat petal. Surprising though it may be, the fringed-edged flower has generally great lasting qualities.

This quality, like all others, can be worked for and obtained. It is never wise to retain a seedling, no matter how beautiful, that

does not keep well in water, or resist to a certain degree the sun in summer. No variety is of any value unless it has good substance and will last well.

COLOUR

The future of the *Dianthus* family is an interesting subject for meditation. The marvellous possibilities of an increased range of colour, the improvement in purity of the present existing shades, forms and habits, and the fact that carnations of varying sizes can be produced, some with climbing, others with dwarf habit, give greater scope to the raiser than is found in any other flower. Yet what I believe to be one of the greatest possibilities of this flower lies in the combination of shades of colour in a flower, in which may be the charming effect found in the rose. I hear so many people say they only like a self flower, and they try not to see beauty in any of the fancy varieties. This undoubtedly is a mistake in the case of the carnation, because one of the natural tendencies of the flower is to produce fancy-coloured varieties, many of which are most beautiful.

Again, the most perfect art shades are found in the carnation, more than in any other flower. Some of them are so delicate that they almost require a trained eye to appreciate them fully. Rarely, if ever, do we have coarse, vulgar shades, or a combination which does not harmonize, for there is great beauty in them all.

In breeding for colour I divide them up into groups, and contend that by this practice I get much purer shades. Whites are kept separate, and cross white on to white, red with red, and sometimes crimson. The pale pinks and salmon shades are kept perfectly distinct from the deep pinks, which are treated separately. The yellow and apricot I keep pure, but sometimes intercross with other colours to try to build up the constitution. All heliotropes, purples, and mauves are kept in one class.

I do not always restrict myself to the largest or most double flowers, but use as a seed bearer a semi-double bloom if its parents for one or two generations back have been large-flowered seedlings. In short, I study the parentage of the seedlings more than the actual plant itself, when I am working for any particular object.

If crosses are made between two of a similar shade year after year, and the process is continued, in course of time almost pure blood of the desired colour is obtained. The colour would then be much richer in tone, but invariably in striving for colour alone scent and robust habit of growth are lost, which naturally destroys all

other efforts. I work for purity of blood, but have separate groups in one colour section, so that it is rarely, if ever, necessary to carry on the interchange beyond the third generation. For instance, in taking seedlings of the red section, I might cross a seedling of a perfectly pure and rich shade of yellow on to one which was practically of pure red blood, yet perhaps a little dull in colour, and whose chief merits lay in its form of flower and perfect habit of growth. By this practice, and by also perpetually bringing other seedlings or occasionally a standard variety into the colour section, I find that I can, with a certain degree of accuracy, obtain novelties superior to present existing varieties.

The sum total of several years' study in breeding for colours is that the most potent parents as to colour, or, indeed, any other characteristics, are those which for many generations of previous breeding have predominated.

The theory that the pollen parent has the greater influence upon colour cannot be taken as binding in the case of close hereditary breeding, although it does show a preponderance of the male colour in mongrel crosses.

In trying to secure perfect shades of pink, I find that the mixing of shades does not matter so much so long as they are from pure pedigree stock, clear, and of a lively tone, free from any magenta shade, and not readily affected by the sun.

FORM

It behoves everyone who endeavours to raise new varieties to have his ideal as to form, no matter what race of *Dianthus* he is trying to develop, as it seems practically impossible to have one perfect type or model for all to aim at.

Each raiser has his own perfect type, some preferring a smooth-edged petal, whilst others champion those with a fringed edge. One upholds the high, full centre, whilst another prefers a loosely built flower. There is the clear-cut shell petal, which somewhat represents the incurved petal; then there is the crimped petal with a sort of rib down the centre, the flowers possessing, as a rule, smaller petals towards the centre.

Many of the new carnations have but a slightly fimbriated edge, which is a decided advantage, because some of the perfectly smooth-edged border varieties are far too stiff and formal; yet, again, the highly fimbriated edge of some of the varieties does not appeal to all. But I can safely say that it would be an evil day for



A vase arranged with skill and taste.



A perfect calyx and correctly formed guard petals.

the dianthus in general, and the carnation in particular, if all the flowers were of exactly the same build.

I predict that the future will bring varieties with large petals in the centre of the flower, which will be high and full, and open like the Tea Rose, giving a similar effect. Some will consider this a dream, but in the thousands of seedlings which for years I have had the joy of raising and flowering, sufficient guide is given to enable me to look into the future with a certain amount of accuracy; and it is this contact with seedling carnations, many of which are most beautiful in spite of their shortcomings, that enables me to see the slow development of the flower, and the improvement in its petallage, particularly in the centre of the flower, which is most marked.

The outer or guard petals (Fig. 99) should grow well out of the calyx, and then expand horizontally, with the inner petals well arranged.

SIZE OF BLOOM

In breeding for size I do not hesitate to use a small-flowered variety as a seed parent, provided that its progenitors of the first and second generations past were large-flowered varieties as pollen parents, and, of course, that it has the other attributes of a good carnation.

There is one thing perfectly certain, and that is, as long as carnations are grown new varieties will be absolutely necessary, because after a variety has been in commerce for a number of years it deteriorates, and is not worth cultivating when compared with the more modern types.

It is a generally accepted fact that fine Malmaisons will not seed, but I never had very great faith in accepted facts in horticulture, because everything connected with it is moving and slowly developing, and after several years I found a system by which to induce some of the varieties of Malmaisons to bear seed. The method was to starve the intended seed-bearing plant in a small-sized pot. It was not disbudded at all until the crown bud was almost fully developed. This was removed, and afterwards I fertilized on to the lateral flowers. The average of success was about one seed pod in every hundred crosses made.

SPORTS

A sport in a carnation is that portion which assumes one or more characteristics essentially different from the rest of the plant, whether in flowers, foliage, or habit. As yet scientists have not

enlightened us upon the cause. Sports in carnations may be encouraged by extreme conditions, such as excessive feeding or great poverty of soil. Darwin says: "Of all the causes which induce variability, excess of food, whether or not changed in nature, is probably the most powerful."

Certain varieties are more sportive than others. It is from old plants more than young ones that sports are obtained, and the sum total of the whole matter is purely one of luck. If cuttings are taken from a growth which has sported, a very large proportion of them will continue to come true to the new form and remain fixed. These are new varieties, and in some cases are of value. As a rule, varieties sport simultaneously in several districts. The careful selection of the best form in propagating is important.

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